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THESIS

Measurements of Ocean Currents Across
the Continental Margin off Point Sur,
California, during March 1989

by

LCDR Anthony J. Negron

March, 1993

Thesis Advisor: Curtis A. Collins

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The Davidson Current flows poleward at the surface in its winter configuration despite northerly winds and coastal upwelling which normally drive the flow subsurface in the summer months..

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Measurements of Ocean Currents Across the Continental Margin off Point Sur, California, in March 1989

by

Anthony J. Negron
Lieutenant Commander, United States Navy
B.S., Jersey City State College, 1978

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN METEOROLOGY AND PHYSICAL OCEANOGRAPHY

from the

NAVAL POSTGRADUATE SCHOOL
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Abstract

Mean currents and density were measured off Point Sur, California in March 1989 using Pegasus and CTD instruments. Velocity, temperature, salinity, and density fields are examined to discern the structure of the California and Davidson currents. Velocities measured by Pegasus are compared to flow fields derived from geostrophy.

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I. INTRODUCTION

The California Current is the eastern boundary current of the subtropical North Pacific gyre extending along the full length of the western portion of the United States. It is a broad, shallow, and weak system of equatorward flow with velocities normally less than 25 cm/sec. The current extends out from the coast to about 900 km with its core about 200-300 km from shore (Simpson 1987). Its flow is contained within 300 m of the surface. The California Current is characterized by subarctic water. This subarctic water mass originates near the West Wind Drift and encounters North Pacific Central water at its western boundary and Equatorial Pacific water as it is carried south.

The California Current system also contains a poleward current closer inshore that exhibits seasonal variability. It is called the California Undercurrent when the current is submerged, or the Davidson Inshore Current when on the surface. The poleward current is somewhat stronger and narrower than the California Current (Simpson 1987). The undercurrent is found at depth in the spring and summer then surfaces in the fall and winter. The undercurrent waters are warmer and saltier than subarctic water and have σ_t values between 26.4 and 26.9 at depths 200 to 400 m (Simpson 1987).

The data used in this thesis was collected during the

period when the Spring Transition usually occurs along coastal California. Huyer (1987) defines the Spring Transition as a large-scale change in the coastal ocean occurring in late March or early April. This change is indicated by a rapid lowering of sea level, a switch to southward surface currents, and coastal upwelling of cold water that results in persistent cross-shelf temperature differences.

Our observations were made to the west of Point Sur, California. The continental margin off Point Sur consists of a shelf extending to a depth of 150 m and 15 km from the coast, followed by a steep continental slope out to 75 km offshore with the basin floor at the depth of 3500 m and about 100 km offshore (Figure 2).

North of Point Sur the continental margin rapidly narrows with the 1000 m isobath less than 8 km from shore with a very steep continental slope. Monterey Canyon is the major bathymetric feature of this region. The head of the canyon is less than 3 km from shore at Moss Landing. Monterey Canyon has smaller tributaries which branch off toward Carmel Bay, the Carmel and Soquel Canyons.

Observational studies of the California Current include the California Cooperative Oceanic Fisheries Investigations (CalCOFI), a long term coastal survey effort whose main objective is the understanding of variations of the fish population and their biotic and physical environment in the California Current. These data have been used to describe

both annual and interannual variability of the California Current System. The interannual variability consists of the vertical motion of isopycnals associated with geostrophic tilting due to large-scale changes in the transport of the California Current (Chelton 1982). This process is uncorrelated with local wind forcing but more closely related to El Nino occurrences in the eastern tropical Pacific. During the El Nino periods, the pycnocline shoals more rapidly toward the coast, and the equatorward transport of the California Current is enhanced. Annual variability in the California Current system occurred within 100 km of the coast. The surface flow in the region was equatorward from March through September and poleward from October through February. At Point Sur, Chelton (1984) found the subsurface flow coherent with the surface.

The California Coastal Circulation Study (CCCS) occurred during an 18 month period from February 1984 to July 1985. CCCS collected current meter measurements, drift buoy trajectories and hydrographic data along a region from Point Conception north to Pigeon Point. This data indicated consistently strong poleward flow over the continental slope from Pt. Conception to Pt Sur during the survey period. This flow appeared to be unrelated to local wind forcing. However, the cause of the poleward flow was not identified (Chelton 1987). The Coastal Ocean Dynamics Experiment (CODE) was a multiyear (1981 to 1983) research effort whose goal was to

obtain data sets of all relevant physical variables needed to construct accurate dynamic descriptions of the response of continental shelf waters to strong wind forcing. Data collection was conducted along a region of the continental shelf north of San Francisco extending from Point Reyes to Point Arena. These studies found that the Spring Transition developed suddenly, over a period of days, in late March to mid-April. The Spring Transition was characterized by a drop in water temperature of 2°-4°C over the shelf, upward sloping isotherms and isopycnals and the establishment of an alongshore pressure gradient which opposed the wind and drove a poleward flow.

Figure 1 is a schematic of isotherms and circulation in an upwelling circulation system along an eastern ocean boundary. Upwelling of more saline, colder, deep water forces the isotherms at the coast upward; flow then moves offshore and sinks due to its higher density, causing downwelling in the thermocline. Isotherms deeper in the water column dome upward in response to the dynamic surface trough. This upwelling circulation process is a consequence of wind stress curl (Smith 1989). My analysis of data collected during March 1989 will show the validity of this upwelling circulation process in the California Undercurrent system off Pt. Sur.

The purpose of this thesis is to analyze the data collected during the March 1989 cruise, and to interpret and compare the results in order to arrive at an understanding of

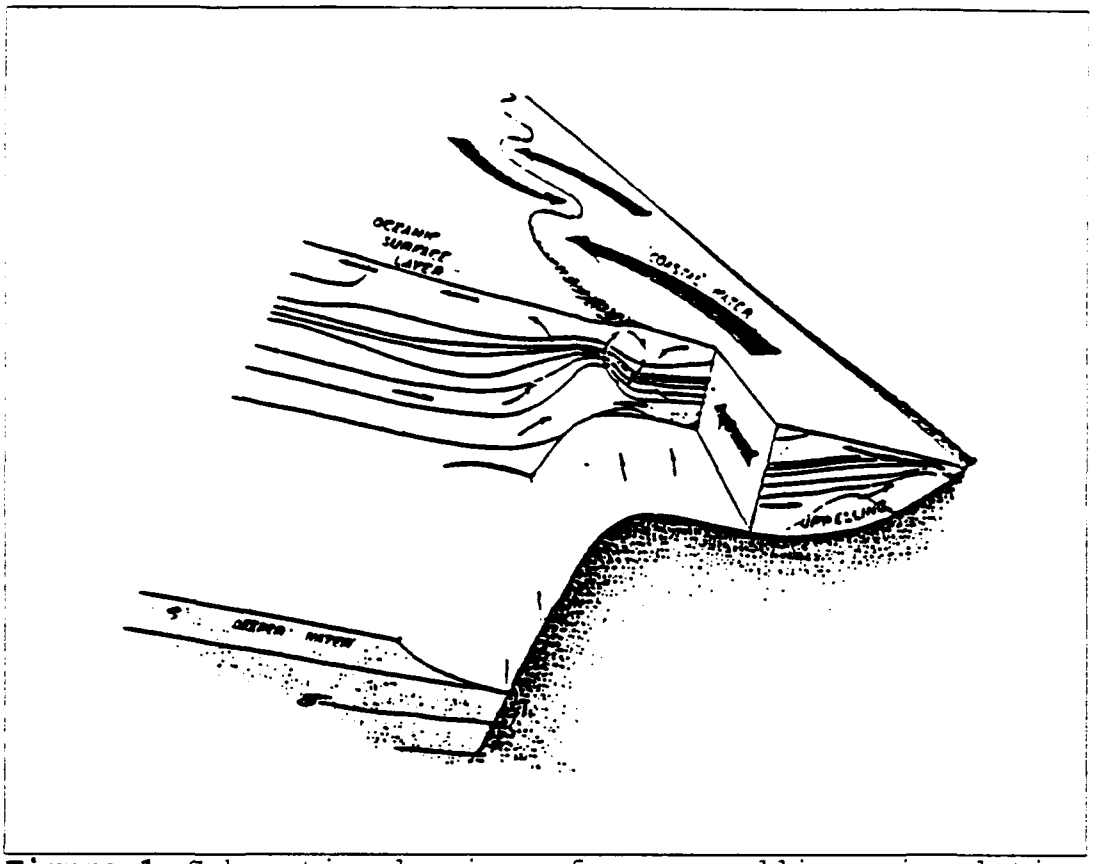

Figure 1 Schematic drawing of an upwelling circulation (Smith 1989)

the flow of the current system during that period.

II. DATA COLLECTION AND PROCESSING

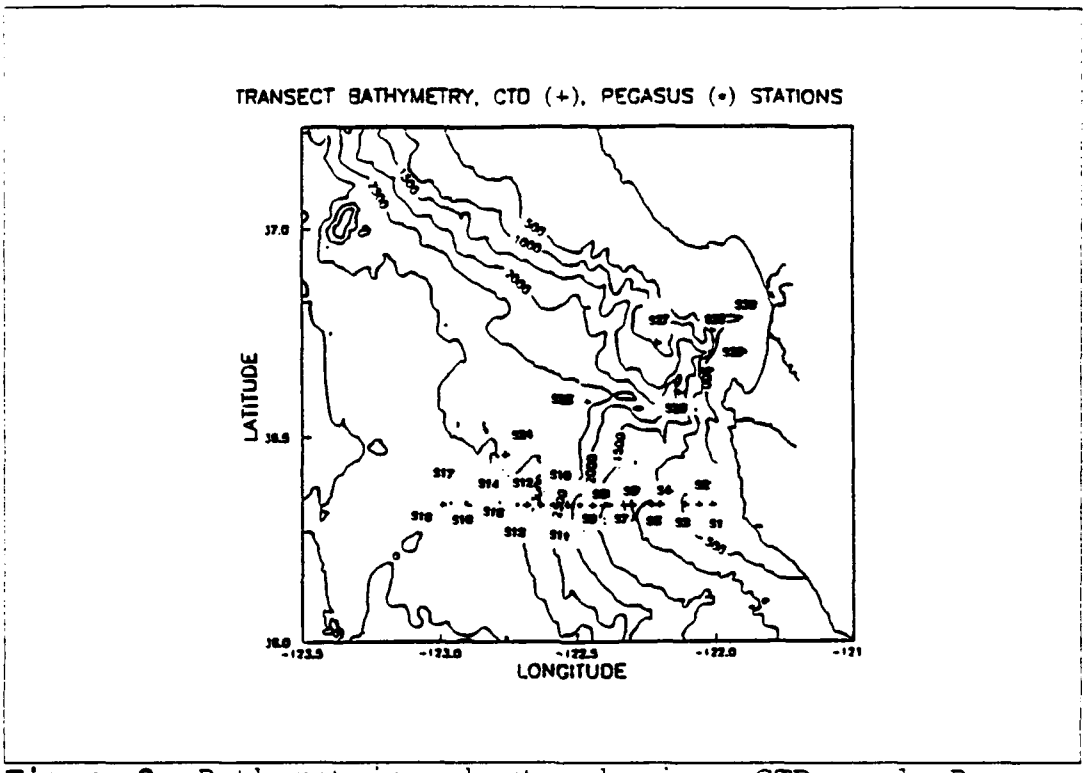

Figure 2 Bathymetric chart showing CTD and Pegasus stations (500 meter contour interval)

The data in this study was collected during the 25-29 March 1989 California Undercurrent Study Cruise conducted by the Naval Postgraduate School along the Point Sur Transect. Tables 1-2 and Figure 2 show the CTD and Pegasus data collection locations along the transect which runs along 36.20°N until it intersects the CalCOFI line 67 at 123°W then turns to the southwest following this line.

To make data analysis easier I broke the transect into two portions (see figure 2); the first section (Pt. Sur Section) runs from station 1, at 36.20°N, 121.56°W (4.6 km from the coast) along 36.20N to station 20, at 36.06°N, 123.31°W (150 km from coast). The Pt. Sur Section crosses the shelf which extends to a depth of 180 m 7 nm from the coast. This is followed by the continental slope extending to a depth of 3060 m 65 km from shore with station 20 located over the basin floor (3540 m depth). The second section (Canyon Section) traces the Monterey Canyon axis starting from station 20 (170 km from the coast as measured from Moss Landing) to station 30 (11 km from the coast).

TABLE 1 CTD STATIONS

NUM	LAT (N)	LONG (W)	DEPTH (M)
1	36°20′	121°56′	60
2	36°20′	121°59′	100
3	36°20′	122°01′	135
4	36°20′	122°05′	298
5	36°20′	122°08′	625
6	36°20′	122°13′	902
7	36°20′	122°15′	985
8	36°20′	122°19′	864
9	36°20′	122°22′	1275
10	36°20′	122°25′	1690
11	36°20′	122°28′	1880
12	36°20′	122°33′	2272
13	36°20′	122°35′	2630
14	36°20′	122°39′	3160
15	36°20′	122°42′	3155
16	36°20′	122°49′	3065
17	36°20′	122°55′	3555
18	36°20′	123°01′	3600
20	36°06′	123°31′	3540
23	36°27′	122°47′	2962
24	36°35′	122°29′	2975
25	36°33′	122°16′	2540
26	36°36′	122°09′	2140
27	36°43′	122°14′	900
28	36°45′	122°02′	1190
29	36°42′	122°01′	1580
30	36°47′	121°56′	565

TABLE 2 PEGASUS STATIONS

NUM	LAT (N)	LONG (W)	DEPTH (M)
104/C1	36°20′	122°16′	980
105/C2	36°20′	122°23′	1381
106/C1	36°20′	122°16′	1021
107/C3	36°20′	122°29′	1857
108/C2	36°20′	122°23′	1373
109/C3	36°20′	122°29′	1855
110/C4	36°20′	122°36′	2658
111/C4	36°20′	122°36′	2650
112/C5	36°20′	122°43′	3275
113/C6	36°20′	122°50′	2991
114/C5	36°20′	122°43′	3238
115/C6	36°20′	122°53′	2991
116/C7	36°20′	122°59′	3295
117/C7	36°19′	122°59′	3284

A. PEGASUS COLLECTION AND CALIBRATION

Pegasus is a free-falling glass sphere which emits an acoustic pulse every 16 seconds to two bottom-mounted transponders whose exact positions and depths are known. These transponders in turn emit a response pulse to Pegasus. Pegasus stores these round trip travel times along with temperature and pressure. This information is gathered during both the downcast and upcast. A more thorough discussion of the instrument is given by Spain (1981).

Pegasus vertical resolution is a function of its falling rate, which is about 38 m/min. The resolution can be changed

by adjusting the ballasting which also determines the time length of cast.

The transponders operated at 12/12.5 kHz and were separated a distance roughly equal to the water depth. Two casts were made at 10 hour intervals at each station to take into account the inertial oscillations which have a period of about 20 hours at the latitude of the stations. The casts were then averaged together into a single profile.

Processing of the raw data into positions and velocities was done by Tarry Rago of the Oceanography Department of the Naval Postgraduate School using Process 1 and Process 2 which were programs designed originally to run on a HP-85 computer (Lillibridge and Rossby, 1987) and adapted to run on IBM-PC computers. The resulting velocities have an accuracy of 1 cm/s (Spain 1981) and are resolved into an eastward component, **"u"** and a northward component, **"v"**. More information on Pegasus processing can be found in King (1989).

B. CTD COLLECTION AND CALIBRATION

Geostrophic velocities were calculated from data gathered using a Neil Brown Mk III CTD. The instrument is considered accurate to within .005 PSU for salinity, .005° C for temperature, and 3.2 dbar for pressure. Its resolution is .001 PSU, .0005° C, and 0.1 dbar. Note that the NPS Oceanography Department's smaller CTD was used for this cruise. The instrument's temperature sensor underwent both

precruise and postcruise calibration, while its pressure sensor only received postcruise calibration to ensure accuracy.

Some problems were encountered in the calibration of the data. The CTD had a pressure-dependent salinity error which was apparent when the difference between the CTD and bottle samples was plotted against pressure. This was caused by a faulty conductivity cell and had to be accounted for in the calibration process. The error was displayed by plotting salinity differences between the true (bottle samples) and instrument (CTD) against pressure. A second order polynomial fit was used to compute fitted salinity differences which were then added to the instrument salinities removing the pressure dependency error. A comprehensive discussion on this and further calibration procedures is found in Tisch (1990).

III. ANALYSIS

A. WEATHER, SATELLITE AND SST INTERPRETATION

The weather pattern for Northern California during the period, 25-29 March 1989, was dominated by a cold front which passed through the Monterey area shortly after 12Z on the 26th. High pressure dominated the area for the rest of the cruise period. The mean winds as recorded at the Monterey Aquarium were westerly before frontal passage shifting to northwesterly afterwards.

The infrared imagery available for 29 March (Figure 3) shows a tongue of 12°C California Current water mixing with 14°C waters west of Point Sur. A filament of this colder water crosses the transect at about station 20. A smaller subdivision of the filament again crosses the Pt. Sur section at station 18. The southern most extension of the filament appears anvil shaped due to cyclonic turning as it mixes with warmer water west of Pt. Sur. This extension appears to be a small scale eddy.

Along the coast, wind driven coastal upwelling, associated with northwesterly winds is found north of Monterey Bay and south of Pt. Sur. Coastal surface temperatures are approximately 10° C. Between stations 26 and 29 there exists a small patch of 10° C water that may be a mesoscale

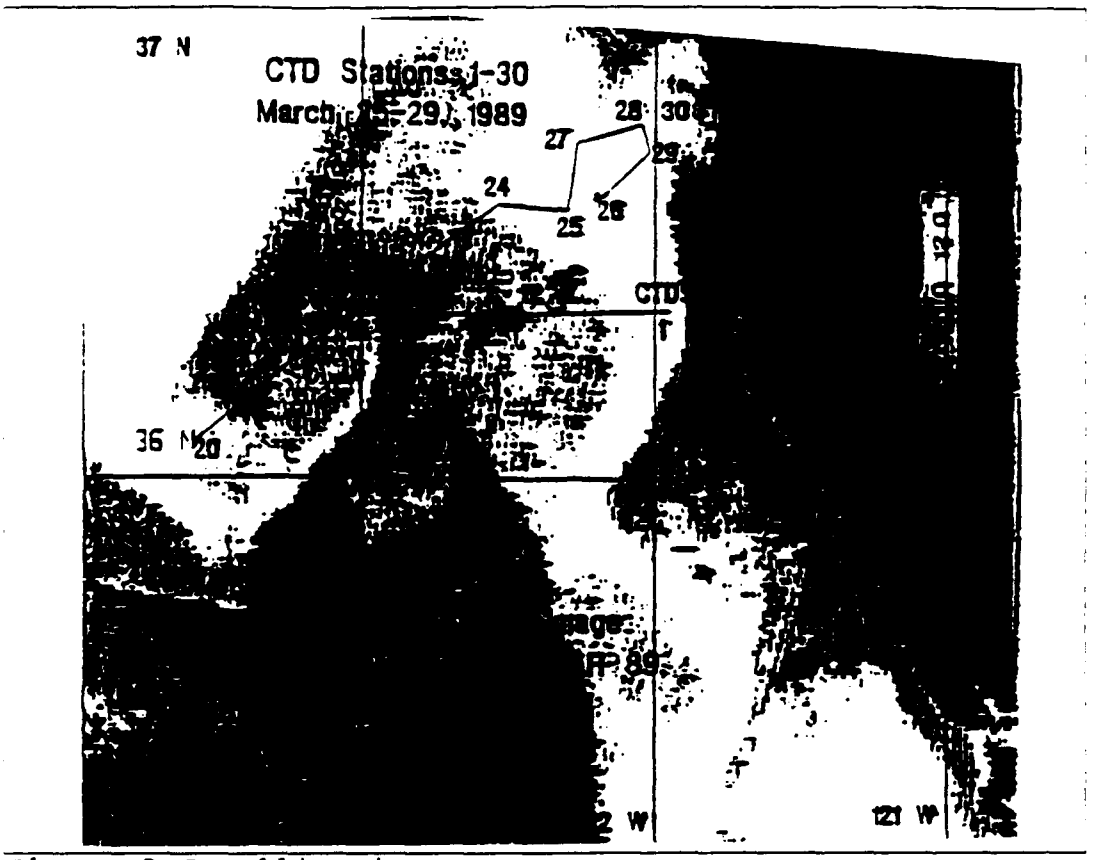

Figure 3 Satellite imagery

cyclonic eddy or more likely cold water driven south from the upwelling to the north of Monterey Bay.

Daily SST values at the Granite Canyon coastal station for January to April 1989 are compared in Figure 4 against a four year average from 1987 to 1990. January and February of 1989 were generally colder than the averaged SST temperatures for those months and somewhat warmer than average in the latter part of April. The averaged SST data shows a gradual cooling from January to March then a sharp 1 degree drop at the beginning of March marking the Spring Transition.

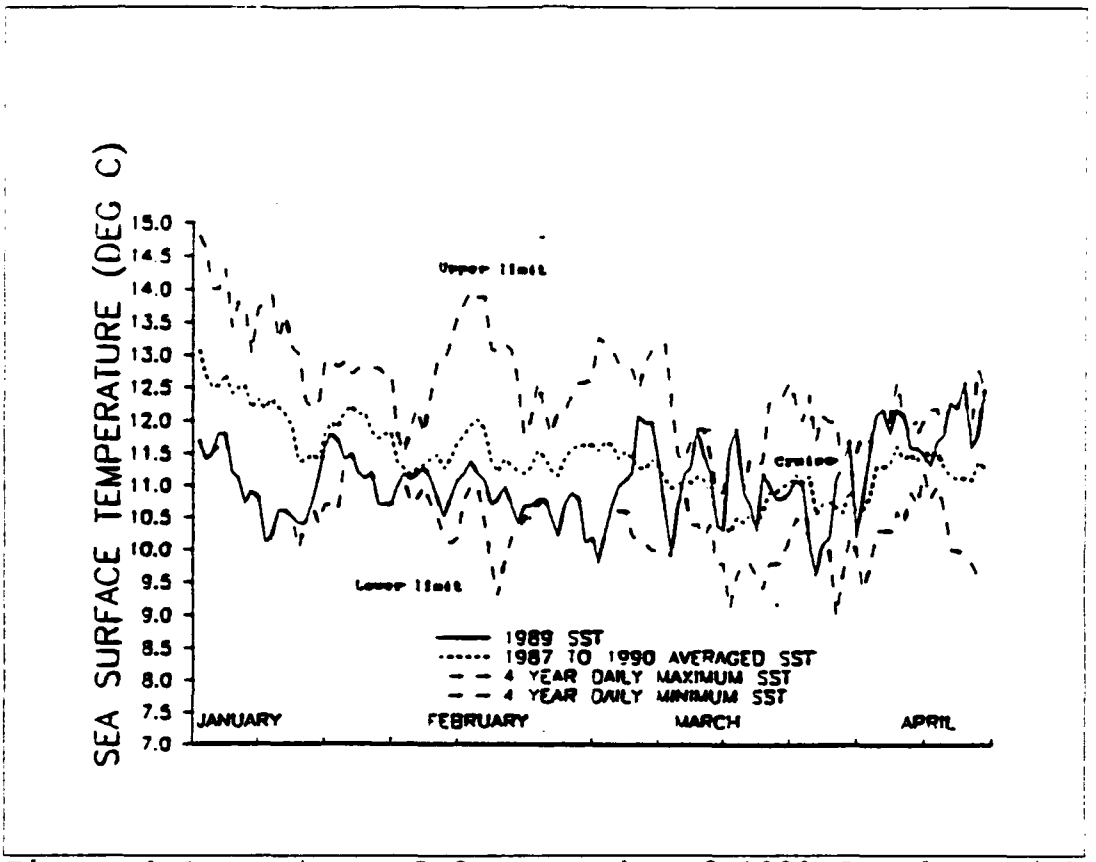

Figure 4 Comparison of four months of 1989 SST data with a four year average from years 1987 to 1990 (10 day periods)

The 1989 SST data are colder than the 4 year averaged SST data during most of January and February. Hence, they do not show a sharp transition or cooling in March. This behavior is consistent with the pattern associated with sea level measurements in Monterey, e.g. sea level lower than normal in January and February (Tisch 1992). Note that during the cruise period of 25-29 March 1989, the SST at Granite Canyon closely matches the four year average.

B. WATER PROPERTY ANALYSIS

1. T/S Relationship

Simpson (1987) found the σ_t = 26.6 surface lies between 200 and 300 m along the coastal margin of Southern California and that the characteristic water mass of the California Undercurrent is centered within this depth during the summer. The σ_t = 26.6 surface is marked by greater variability of salinity than all other σ_t surfaces indicating the level of greatest contrast between waters of equatorial and subarctic origin.

In Figure 5, Appendix A temperature vs salinity data is plotted. Greater salinity variability in the region between 4.5°C and 7.5°C indicates the contrast of subarctic water and water of equatorial origin (California Undercurrent). This variability corresponds to depths of 250-800 m and to density anomaly values of 26.6 to 27.2 kg/m^3. Because of intrusions of different water masses, individual casts were not mixed uniformly at these depths but tended to show fresher water offshore. Least saline waters (< 34.2 psu) which are most characteristic of subarctic water appear in data from the survey station found furthest offshore.

Waters characteristic of deeper water masses dominate the lower end of the observed T/S diagram (figure 5) with the stratification below 4.0°C disproportionately influenced by temperature.

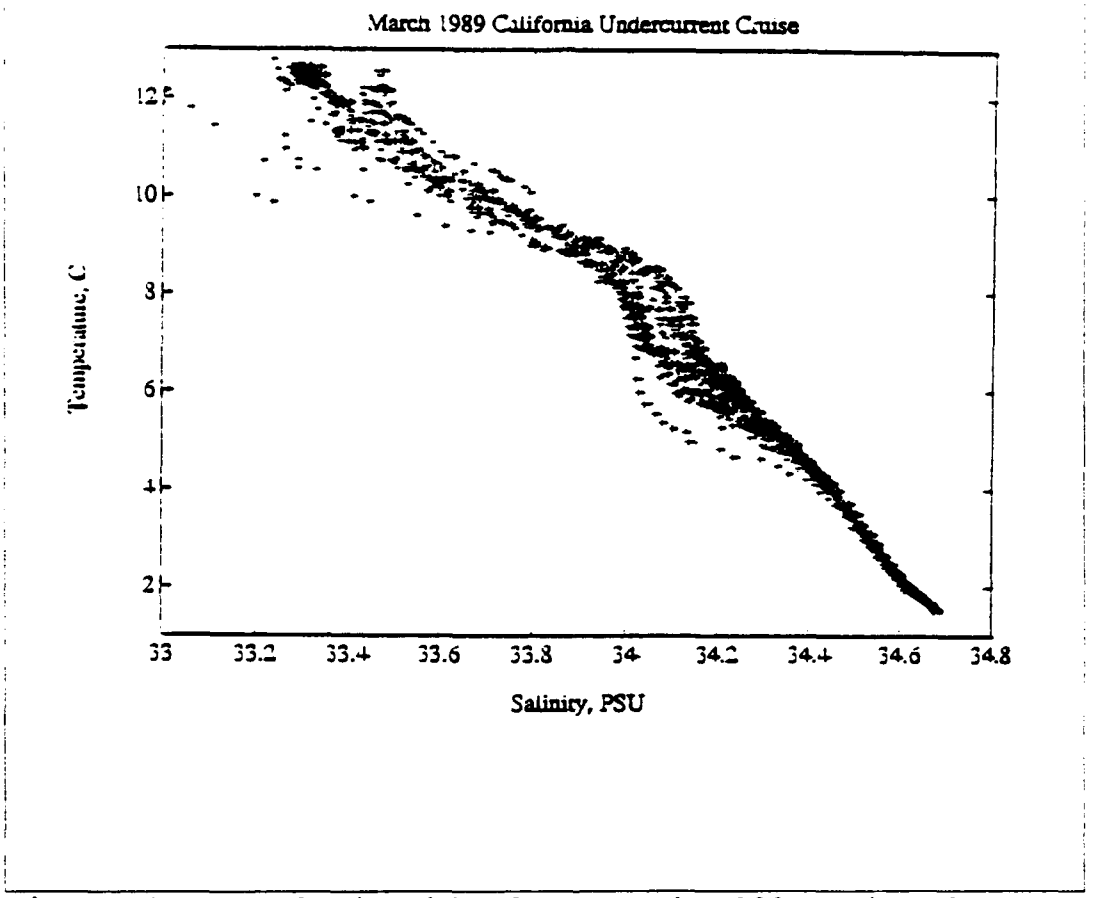

Figure 5 T/S relationship from March 1989 cruise data

2. Temperature

In Figure 6 the upper portion of the thermocline is delineated by the 12.0-9.5°C isotherms. The bottom of this layer extends below 120 m at its deepest at station 9 and is less than 50 m at its shallowest point at station 20. The mixed layer is very shallow (35 m at its deepest 45 km from shore) to nonexistent in the western portion of the section.

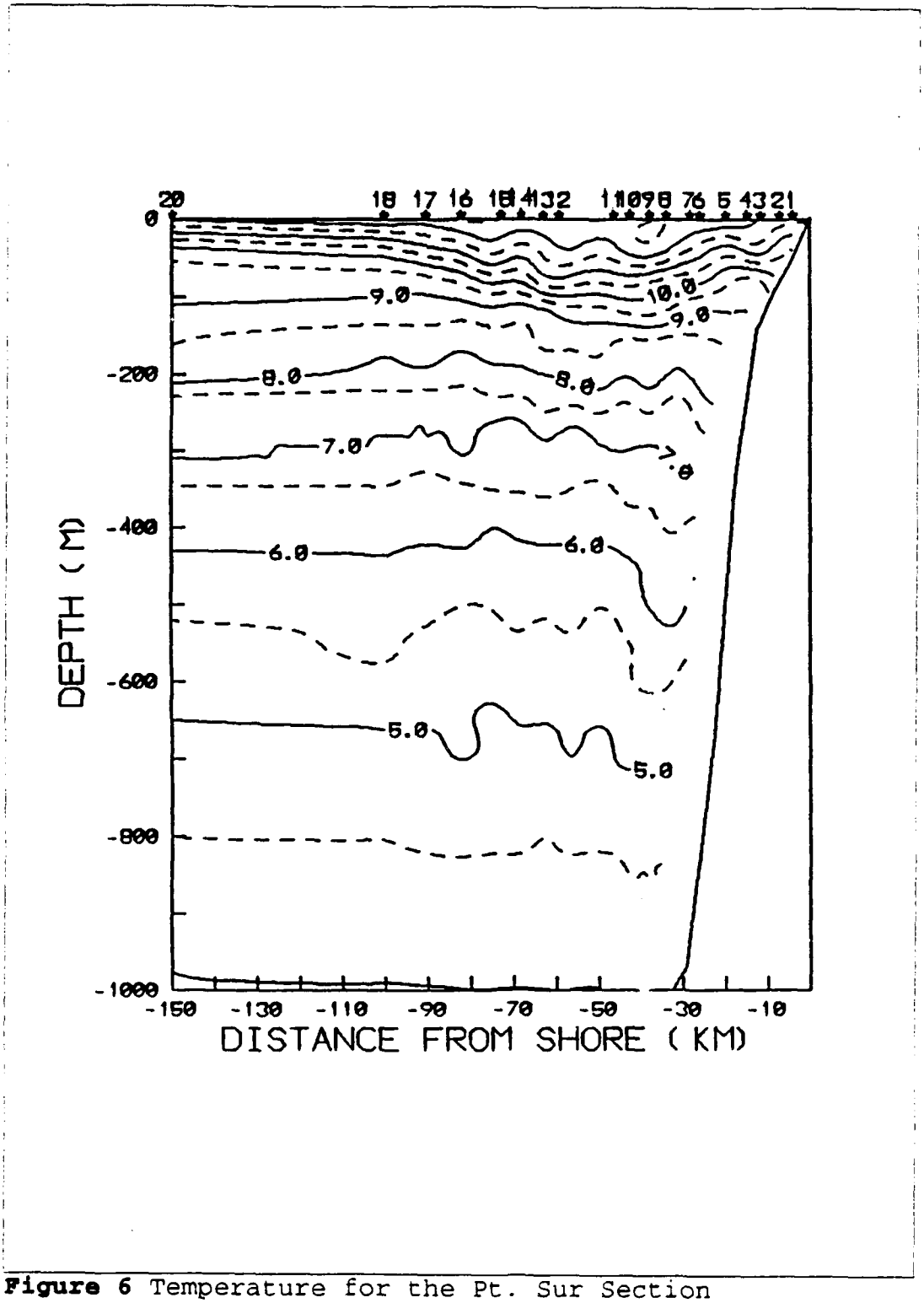

Figure 6 Temperature for the Pt. Sur Section (contour interval of 0.5 °C)

A pool of water, greater than 12°C and at depths less than 50 m exist between stations 4 and 17. The warmest surface temperatures (13°C) exist between stations 8 and 9 and between stations 15 and 16. Coastal upwelling is seen by the shoaling of the 10.5 to 11.5°C isotherms between stations 1 and 3. At station 20 the intensity of the thermocline increases as the 9.5°C isotherm shoals to 50 m. This is associated with the cold waters of the filament (see Figure 3) which crosses the section there.

The 4.5-9.0°C isotherms are horizontal between stations 18 and 20 and between 100 and 800 m in depth, with the exception of the 7.0°C isotherm which downwells sharply 30 m 120 km from shore and the 5.5°C isotherm which downwells 60 m at station 18. At station 16 the 5.0°C and the 7.0°C isotherms downwell 50 m. At station 14 the 8.5°C isotherm downwells 30 m. Imposed on the 7.0, 5.5 and 5.0°C isotherms shoreward of station 16 are a number of undulations with a maximum amplitude of 50 m. The undulations are not in phase at all depths.

The deeper isotherms from 8.0 to 5.0°C (190 to 680 m) within 50 km of the shore downwell as much as 80 m toward the coast. This is the thermal signature of the undercurrent which is composed of warm waters from subtropical latitudes transported northward in a band along the coast.

Figure 7 shows the temperature at the Canyon section. The warmest surface waters (12.5°C) exist around station 23.

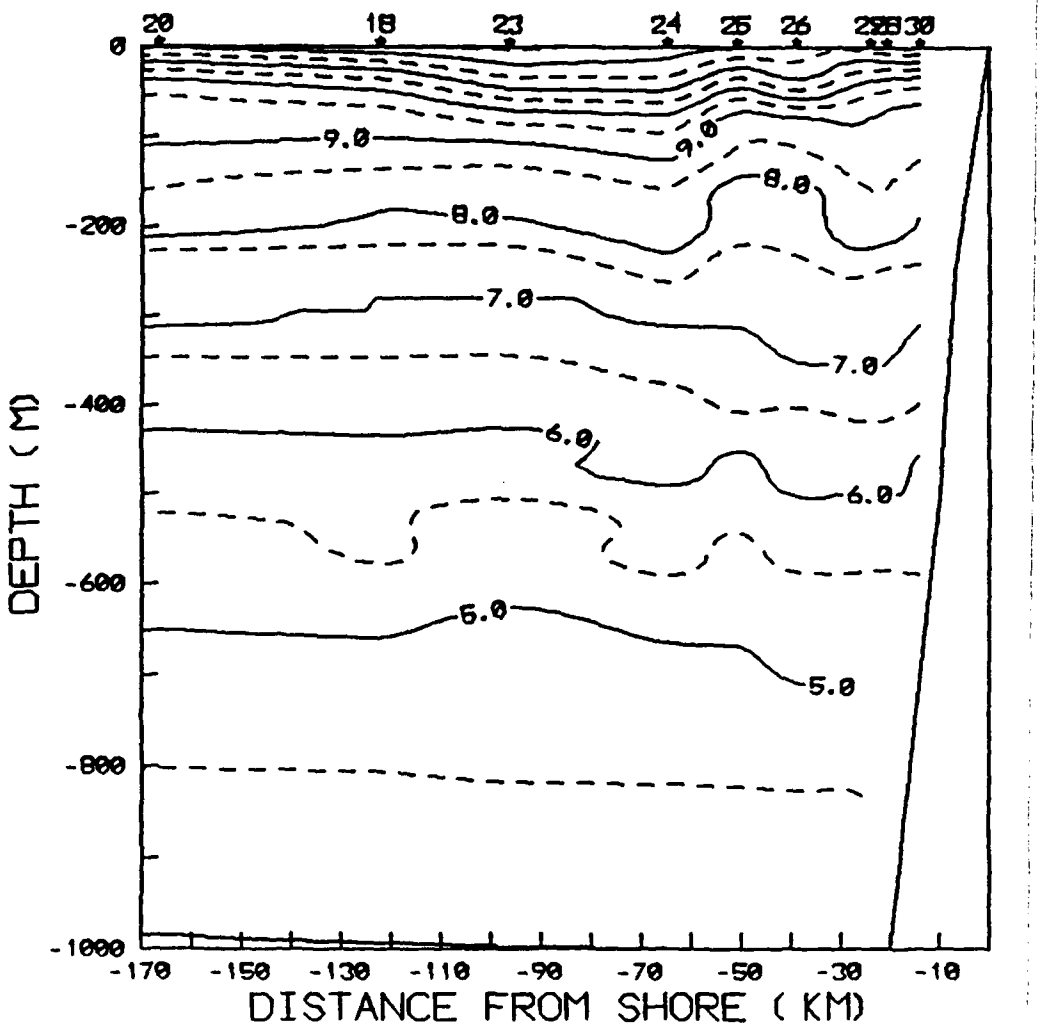

Figure 7 Temperature for the Canyon Section (contour interval of 0.5 °C)

As above, the upper portion of the thermocline is delineated by the 12.5-9.5°C isotherms. Shoaling of this section of the thermocline at station 25 may mark a upwelling filament across the mouth of Monterey Bay. At station 20 shoaling of the upper portion of the thermocline is associated with the cold filament seen in the satellite imagery (Figure 3).

As described for the previous figure the 4.5 to 9.0°C isotherms are generally horizontal between stations 18 and 20 except for the 5.5°C isotherm which downwells 60 m. The downward slope of the 5.0 to 8.0°C isotherms towards the coast at station 23 marks the temperature signature of the warm undercurrent as it crosses the Monterey Canyon axis. At station 25 the 7.5 to 9.0°C isotherms upwell as much as 60 m in conjunction with the upwelling circulation system described above for the upper part of the thermocline while the 5.5 to 6.0°C isotherms upwell as much as 50 m. The 4.5°C isotherm is horizontal across the entire section.

3. Salinity

Figure 8 shows the vertical distribution of salinity across the Pt. Sur section. The upper portion of the halocline is delineated by the 33.4 and the 33.9 isohalines. The bottom of this layer extends below 150 m at its deepest between stations 11 and 12. Within 15 km from shore the 33.4 to 33.6 psu isohalines upwell 40 m associated with coastal upwelling. In contrast the intensifying of the upper portion

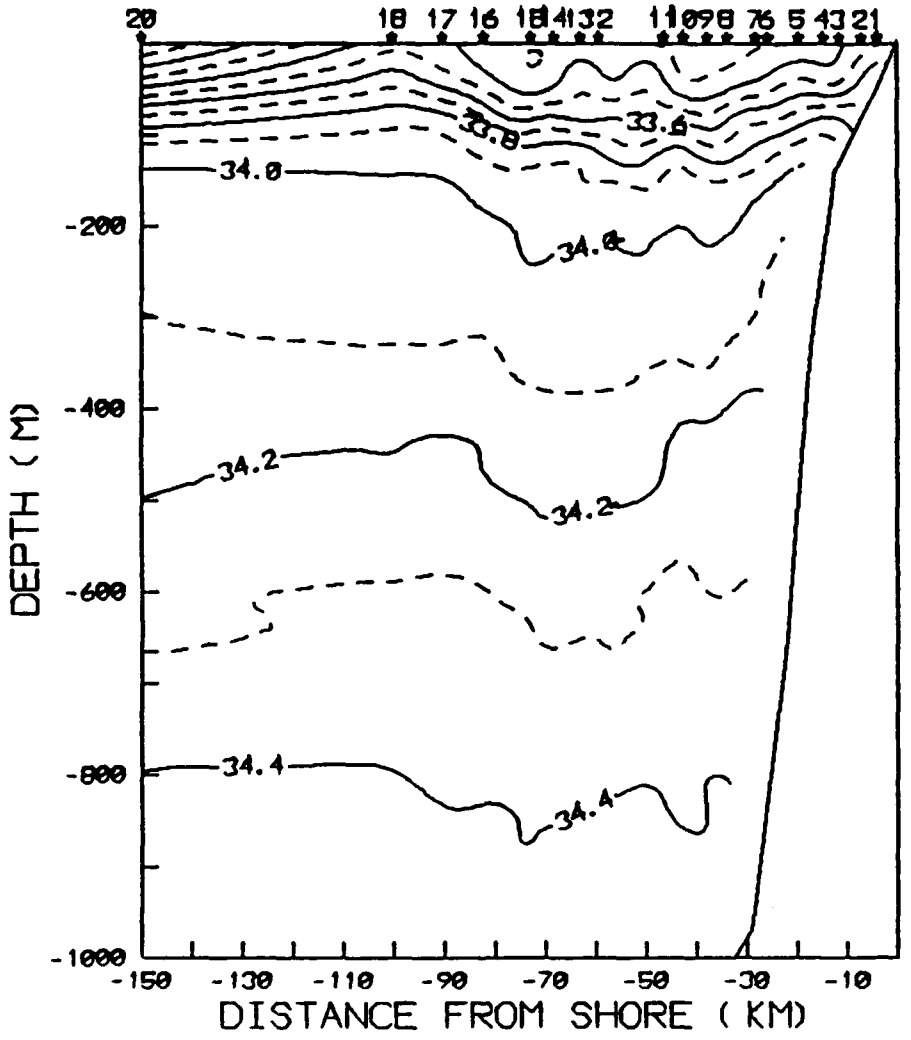

Figure 8 Salinity for the Pt. Sur Section (contour interval of 0.1 psu)

of the halocline from station 18 to station 20 is associated with fresher waters of the cold filament discussed previously crossing the section at station 18 (see satellite imagery).

Between stations 5 and 11 (30 to 55 km from shore), upwelling (as much as 180 m) of the 34.0-34.3 psu isohalines at depths between 200 and 700 m is the signature of the undercurrent. The undercurrent is composed of salty equatorial waters flowing poleward along the continental slope. Analysis of the salinity data compares favorably in location with the temperature signatures of both the upwelling and undercurrent systems discussed in the previous section.

Freshest near surface waters are generally between stations 7 and 11 (defined by the 33.3 psu isohaline). At depth between stations 11 and 16 fresher water can also be found as indicated by the 34.0 to 34.4 psu isohalines which downwell a maximum of 60 m. The source for this fresh water is unknown. These fresher surface waters are likely offshore water caught between a coastal upwelled salinity front and an offshore feature. During upwelling, salty waters are transported offshore by cross-shelf flow. During a period of wind relaxation this flow does not persist and allows for the generation of water which is relatively salty but warmer than the upwelled water. However with the starting of a subsequent upwelling event this saline water loses its high-salinity signature due to vertical mixing as it is advected offshore forming a pool of relatively fresher water (Send 1987).

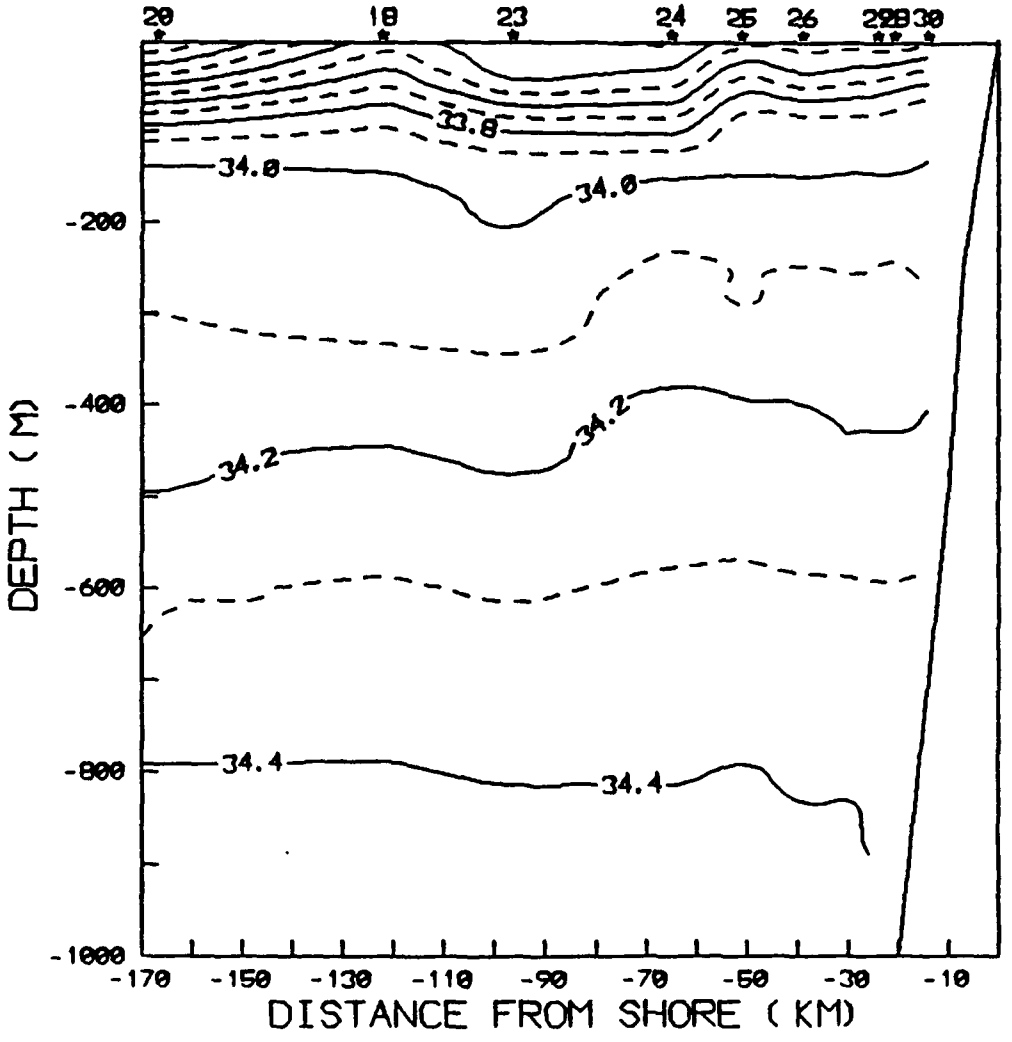

Figure 9 Salinity for the Canyon Section (contour interval of 0.1 psu)

Figure 9 is a vertical distribution of salinity for the Canyon section. The 34.0 psu isohaline which lies at about 200 m serves to divide the upper and lower layers. Fresher waters are found along the surface from station 23 to station 25. Intensification of the upper part of the halocline (the 33.4 to 33.9 psu isohalines) at station 25 marks upwelling at the mouth of Monterey Bay. The halocline is most intense between stations 18 and 20 associated with salty surface waters there. The halocline is nearly level from station 25 to station 28 followed by slight upwelling between stations 28 and 30.

At 200 to 700 m depth, the 34.0 to 34.2 psu isohalines upwell 75 m between stations 23 and 24 marking the signature of the salty undercurrent. Inshore of station 24 the 34.0 isohaline shoals slightly while the 34.1 to 34.4 isohalines begin to deepen. At station 20 the 34.1 psu isohaline shoals slightly while the 34.2 and 34.3 psu isohalines begin to deepen.

4. Density Anomaly (γ_θ)

Figures 10 and 11 are vertical sections of potential density anomaly (γ_θ). Density anomaly is defined as the density of water (ρ) calculated as a function of potential temperature (θ) referenced to 0 dbar, *in situ* pressure (p), and salinity (s), minus 1000 kg/m^3 (UNESCO 1991), i.e.

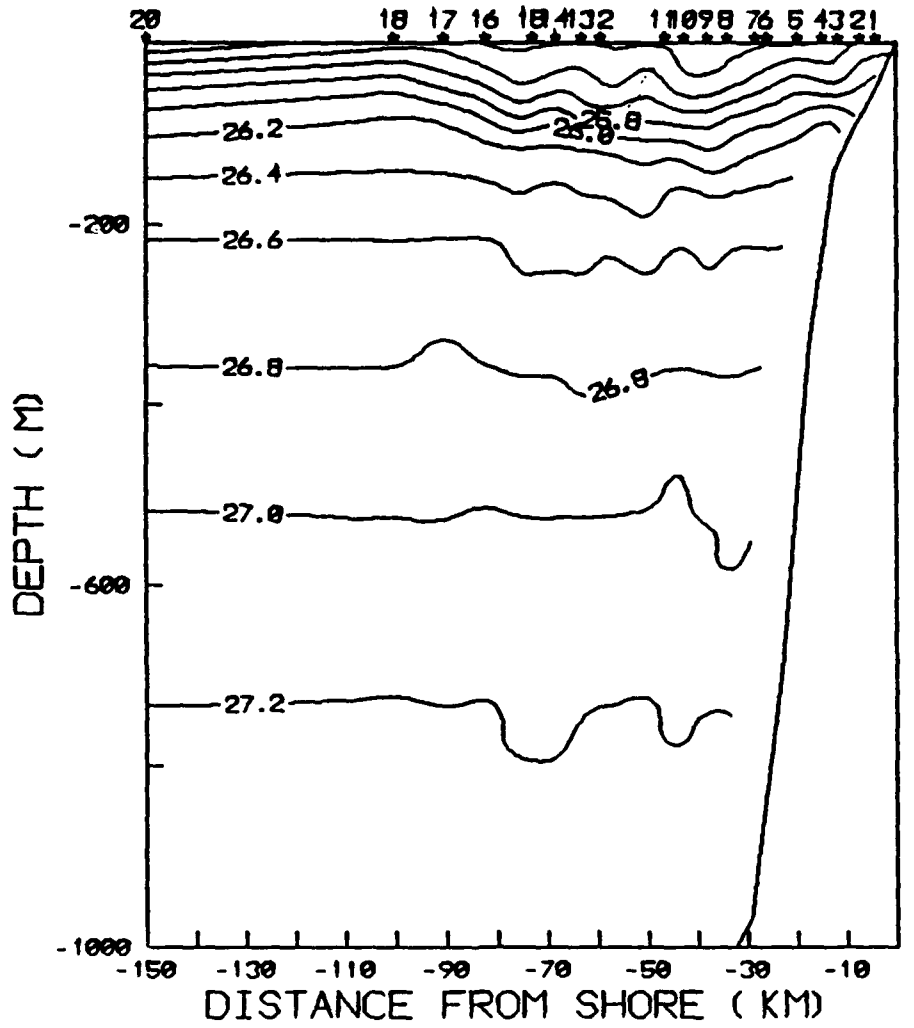

Figure 10 Density (γ_θ) for the Pt. Sur Section (contour interval of 0.2 kg/m^3)

$$\gamma_\theta = \rho(\theta, s, p) - 1000 \quad kg/m^3 \qquad (1)$$

Figure 10 shows the vertical distribution of potential density anomaly across the Pt. Sur section. The seasonal pycnocline is delineated by the 26.2 kg/m^3 isopycnal. The figure shows the seasonal pycnocline extending throughout the cross-section with its deepest point (150 m) between stations 8 and 9 and shoaling to less than 100 m at either end of the section. Upwelling can be distinguished by a sharp upward tilt of the near surface 25.4 kg/m^3 isopycnal along the coastal boundary within 20 km from shore. The shallowing of the 25.4 kg/m^3 isopycnal from 50 m at station 16 to less than 10 m at station 18 is associated with the denser surface water of the filament discussed in previous sections.

The 26.6 to 27.2 kg/m^3 isopycnals are horizontally stratified at station 20. East of station 18 the 26.4 to 27.2 kg/m^3 isopycnals exhibit a pattern of out of phase undulations with a maximum amplitude of 60 m in the 27.0 kg/m^3 isopycnal at station 10. The undercurrent position is associated with the slight downward sloping of the isopycnals between 26.4 and 27.0 kg/m^3 within 40 km of the shore. These isopycnal surfaces are consistent with geostrophy with downward sloping isopycnals indicating poleward flow.

Figure 11 shows the vertical distribution of potential density anomaly across the Canyon section. As in the

previous figure the seasonal pycnocline is delineated by the 26.2 kg/m^3 isopycnal surface. The seasonal pycnocline extends across the figure with its deepest point (100 m) 80 km from shore shallowing to 45 m at station 18 and to less than 35 m at station 25 marking the upwelling across the mouth of Monterey Bay. At station 18 the pycnocline shoals, associated with the denser cold filament crossing the section there.

West of station 24 (70 km) the slight downward tilt of the 26.6 to 27.0 kg/m^3 isopycnals mark the undercurrent as an area of poleward flow as derived from geostrophy.

West of station 18 the 27.0 kg/m^3 isopycnal downwells 25 m. East of station 24 a number of undulations not in phase at all depths appear on the 26.6, 27.0, and 27.2 kg/m^3 isopycnals.

5. Spiciness (π)

Spiciness, calculated by the method of Flament (1986), is a direct measure of the differences between temperature-salinity properties along constant density anomaly lines. Spiciness serves as a tracer of water mass characteristics. At a given density anomaly, water that is warmer and saltier has a higher spiciness than water that is cooler and fresher.

Figure 12 shows the vertical distribution of spiciness values across the Pt. Sur section. The spiciness value of 0.15 delineates an area of higher spiciness located within 100 m of the surface between station 4 and station 18. This value

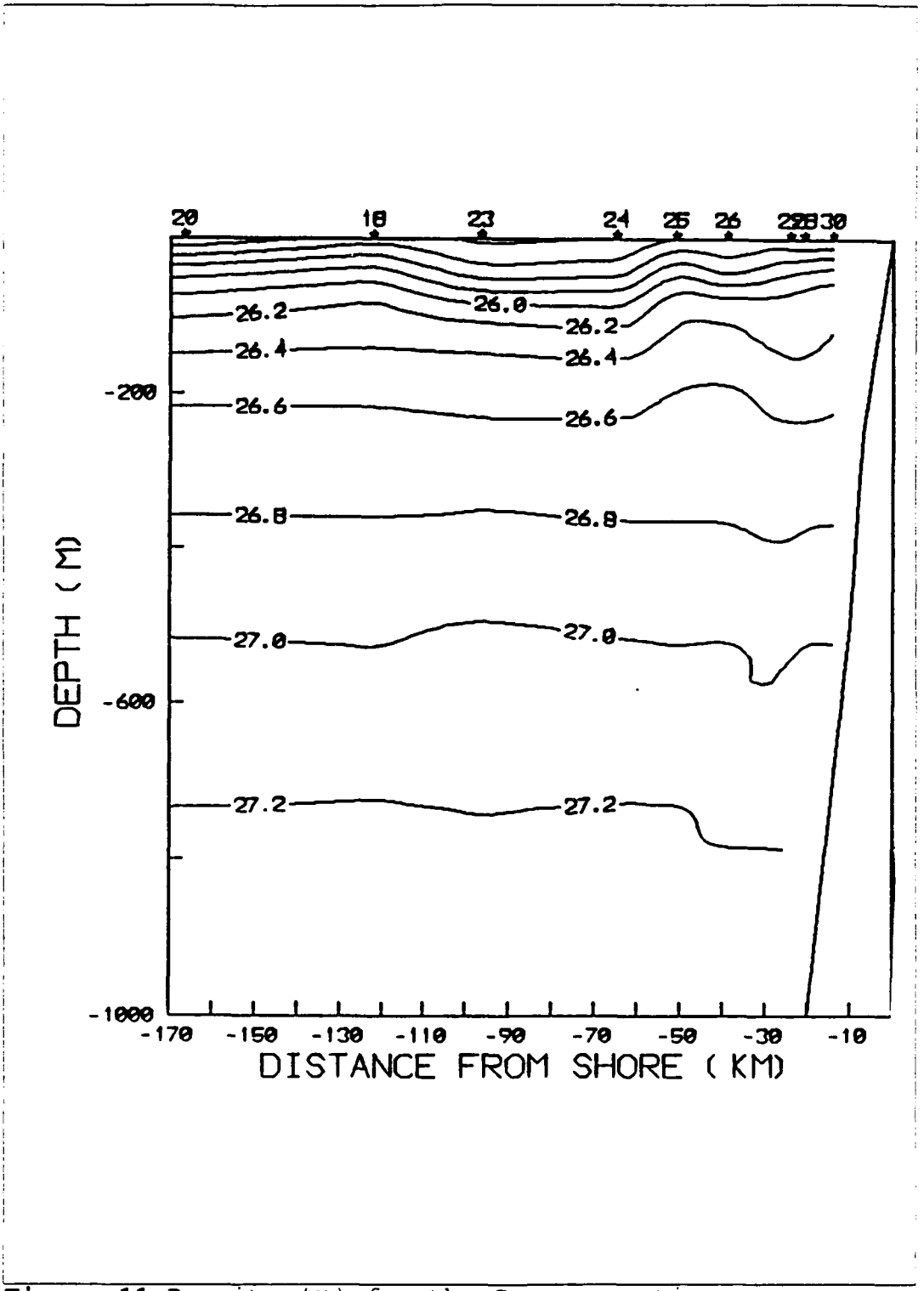

Figure 11 Density (γ_t) for the Canyon section (contour interval of 0.2 kg/m^3)

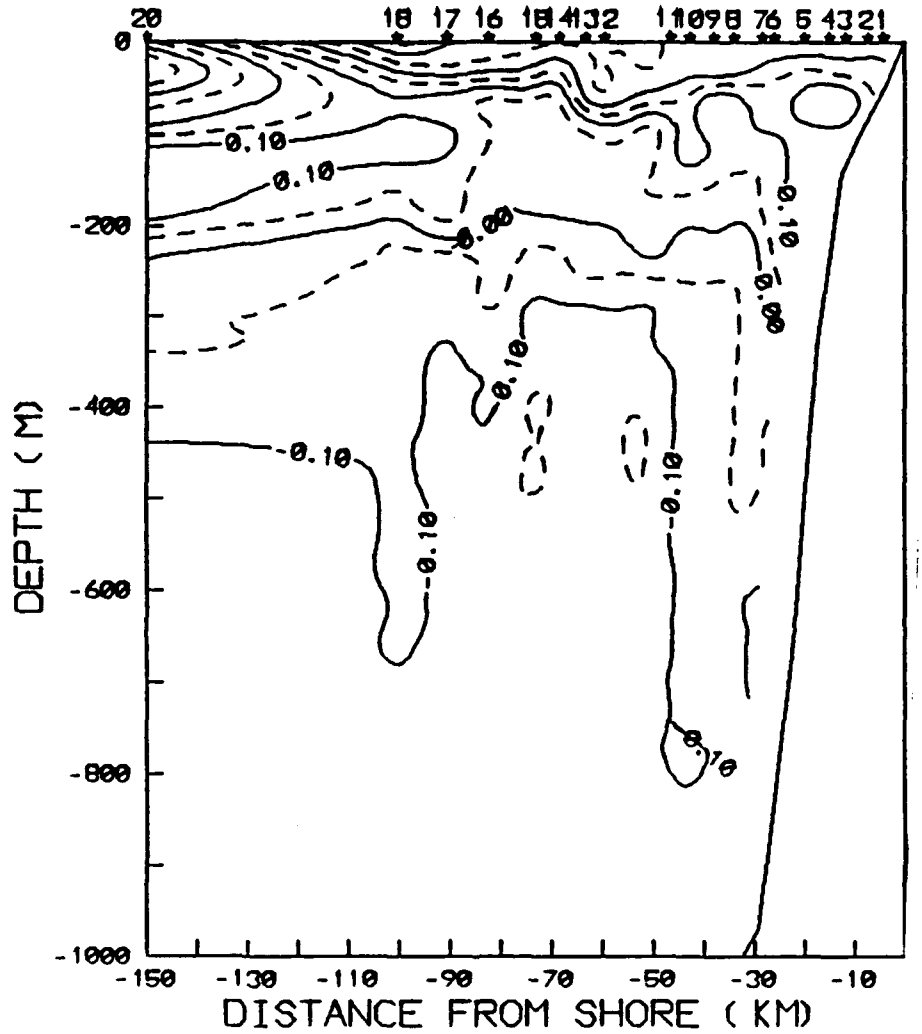

Figure 12 Spiciness for the Pt. Sur Section (contour interval of 0.05)

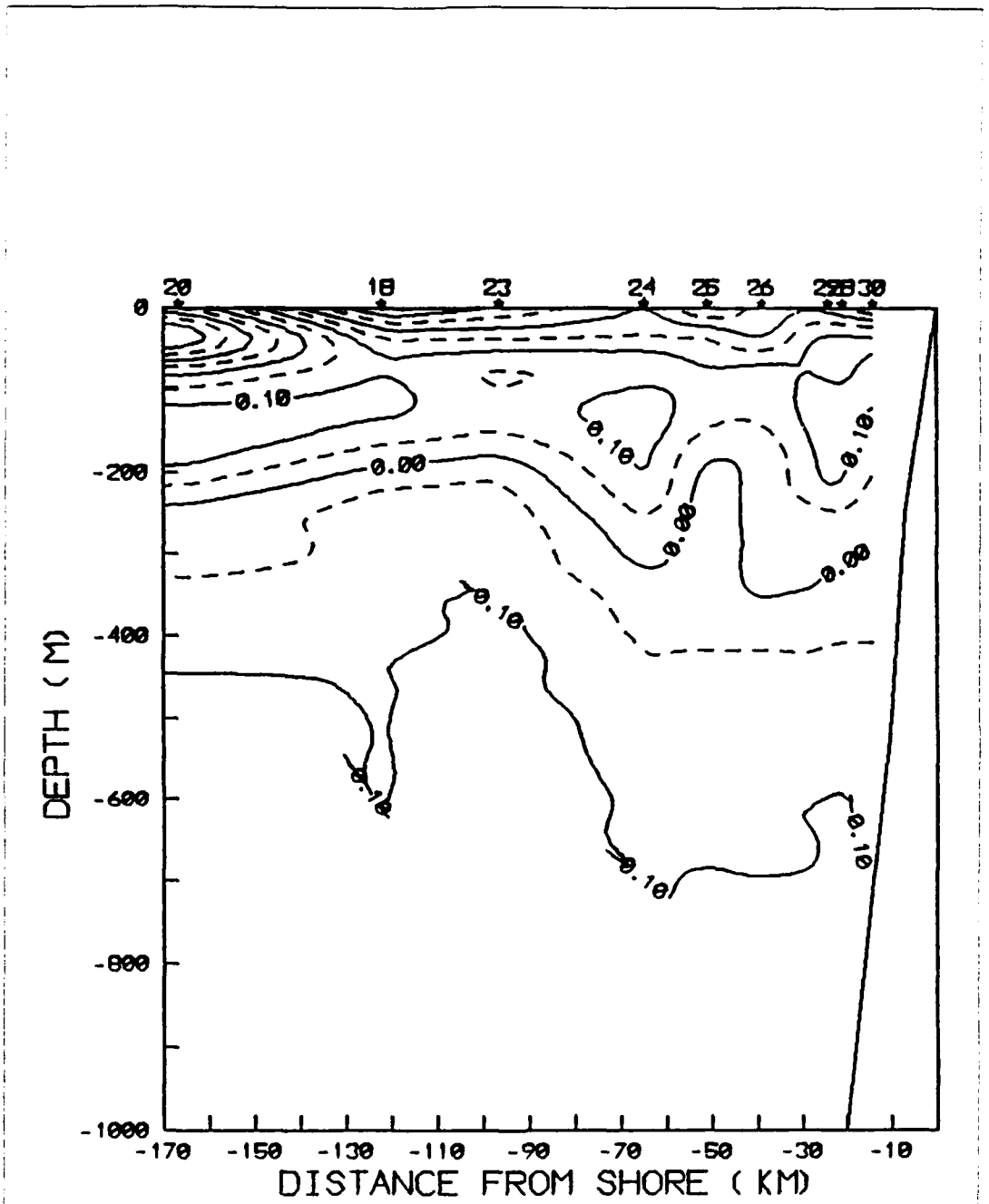

Figure 13 Spiciness for the Canyon Section (contour interval of 0.05)

has a minimum depth of less than 5 m 118 km from shore and a maximum depth of 105 m at station 12. This is consistent with the temperature values seen in figure 6 which indicate warmer average temperatures in the upper 100 m between stations 6 to 14. Largest values of spiciness (0.3) lie near the surface between stations 17 and 18. The undercurrent is clearly marked by the downwelling spiciness values between 0.1 and -0.1 within 50 km from shore. This indicates warmer, saltier water of an equatorial nature. Negative values of spiciness (-0.15) at station 20 at depths less than 100 m are associated with the colder and fresher waters of the filament crossing the track there (see figures 3, 6, and 8).

Figure 13 shows the vertical distribution of spiciness across the Canyon section. As in the previous section the value of 0.15 delineates a layer of higher positive spiciness values within 100 m of the surface extending across the section. The downwelling (as much as 350 m) of the 0.05 to -0.10 spiciness values at station 24 between 200 and 600 m marks the undercurrent as it crosses the Monterey Canyon axis. As in the previous figure negative values of spiciness (-0.15) at station 20 are associated with the cold, fresher waters of the filament crossing the section there.

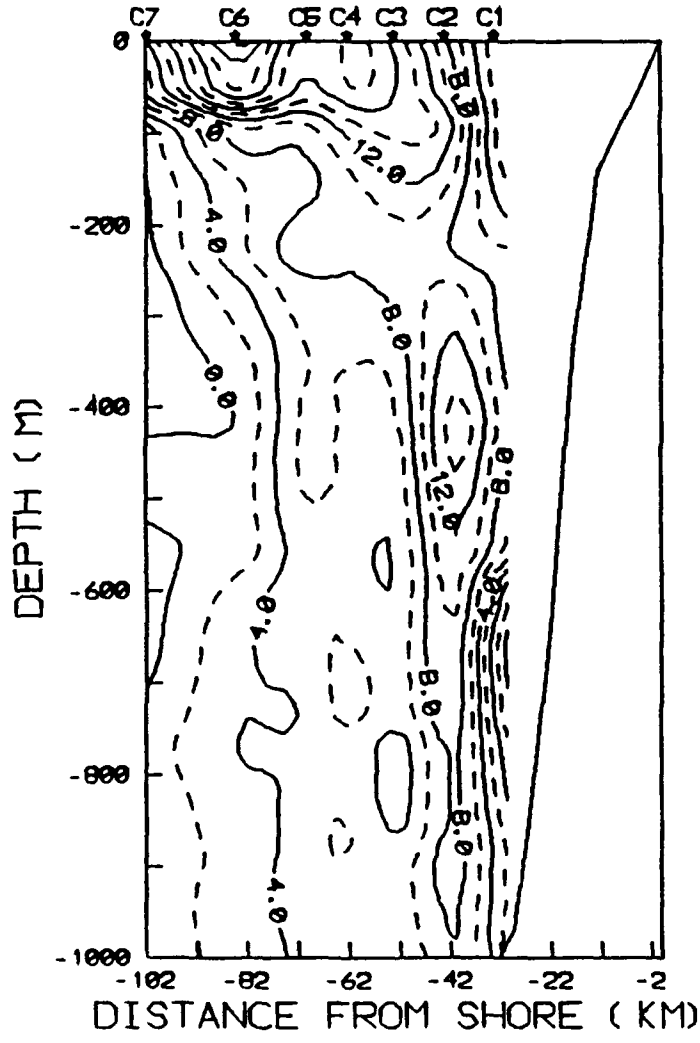

Figure 14 Pegasus velocity (v component) (contour interval of 2 cm/s)

C. VELOCITY

1. Pegasus Velocity

Figures 14 and 15 are the vertical distribution of the **v** component (positive northward) of Pegasus derived velocity. In figures 14 and 15 northerly (poleward) flow dominates the section down to a depth of 4000 m from station C1 to station C6 (90 km from shore). Strong poleward flow with velocities of 26 cm/s dominates the surface to 100 meter layer near station C6. The core of stronger velocities on the surface combined with previous analysis offers further evidence of a mesoscale feature (eddy) of cyclonic nature impinging across the western half of the Pt Sur section. A deeper core of poleward velocity associated with the California Undercurrent extends to a maximum depth of approximately 650 m at some 45 km from shore under station C2. This flow reaches maximum velocities of 14 cm/s. Onshore of station C2 and above 200 m the **v** component weakens to less than 8 cm/s. At 800 m 32 km from shore this flow is extremely weak with velocities no greater than 4 cm/s. Below 1400 m the flow weakens to less than 4 cm/s.

Figures 16 and 17 are the vertical distribution of **u** (positive east) component Pegasus derived velocity. The figures show weak onshore flow in the upper 350 m from 30 to 60 km from shore. This flow is unexpected as coastal upwelling should produce relatively shallow offshore flow.

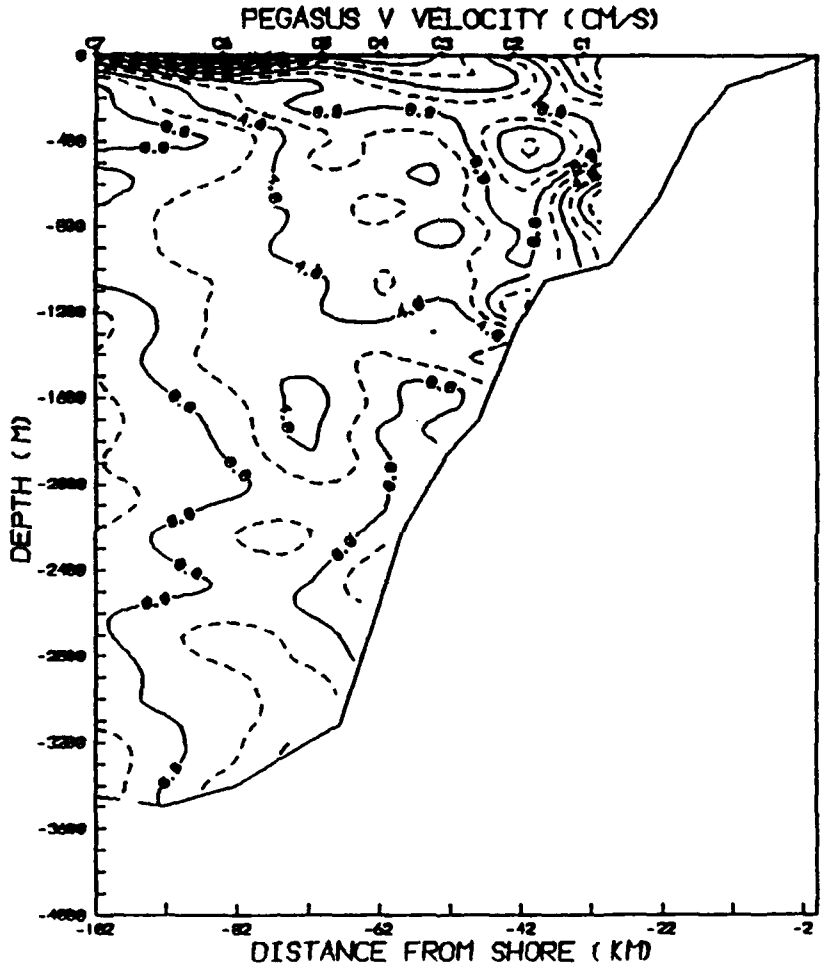

Figure 15 Pegasus velocity (v component) (contour interval of 2 cm/s)

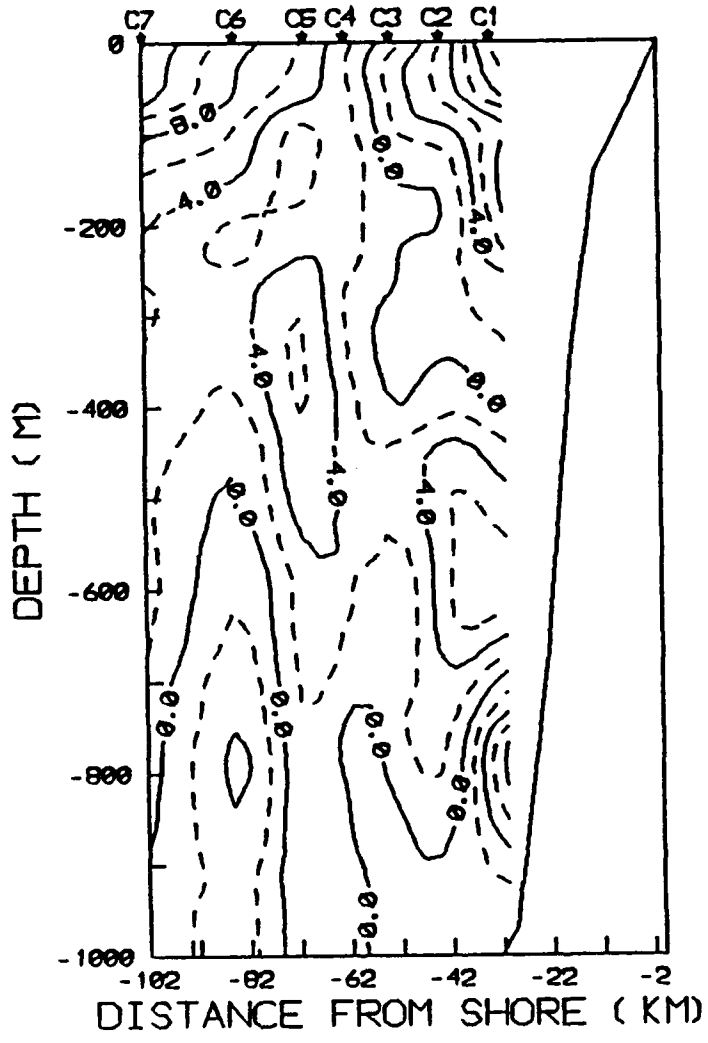

Figure 16 Pegasus velocity (u component) (contour interval of 2 cm/s)

This flow may be a dynamic response to near-surface convergence inshore of station C1 as dense upwelled water moves westward and sinks. The maximum onshore velocity of this regime is 12 cm/s.

Underlying this flow is a contrasting regime of westward flow with a maximum velocity of 4 cm/s. This flow pattern starts along the continental shelf at 600 m, runs horizontally across the section to eventually rise to the surface at a distance of 65 km from shore. This flow may reflect an area of egress for those waters which are downwelled as a result of near-surface convergence caused by the onshore flow described above and the offshore flow from coastal upwelling.

Lastly seen in the section is a band of eastward water flow (8 cm/s) along the shelf at 800 m. Berryman (1989) described a 200 meter thick core of water at this same location flowing southeast between an extensive topographic ridge and the continental slope 33 km from the coast. He theorized that this flow might be part of a topographically steered phenomenon related to winter flow out of Monterey Canyon with most of the velocity in the **u** component.

2. Geostrophy

It is possible to compute currents from hydrographic data by assuming that horizontal pressure gradients are balanced by apparent forces due to the earth's rotation. The

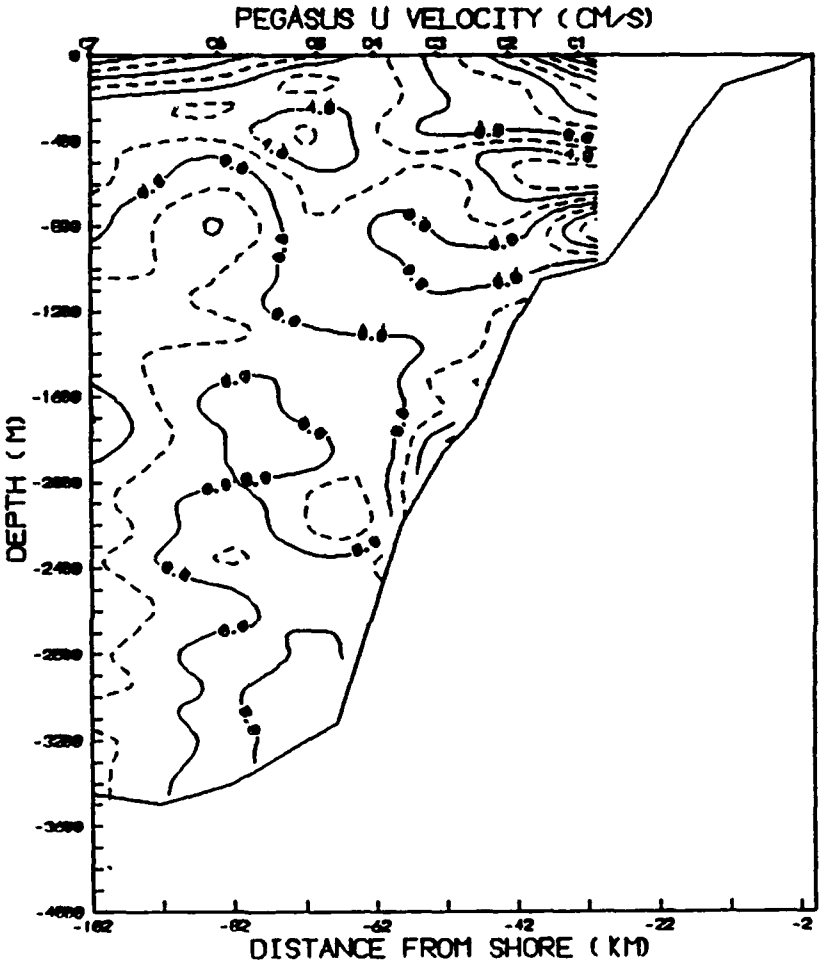

Figure 17 Pegasus velocity (u component) (contour interval of 2 cm/s)

later force is known as the coriolis force and it varies with latitude. This balance of forces is called "geostrophy" (Pond and Picard, 1983).

a. Dynamic Considerations

Geostrophic current velocities are calculated from the horizontal gradients of geopotential, ϕ,

$$- fv = -\partial\phi/\partial x \qquad fu = -\partial\phi/\partial y \tag{2}$$

where f is the Coriolis parameter. The Oceanography Department at NPS uses standard computer programs (Unesco 1983) to calculate values of density, dynamic height, and geostrophic velocity from CTD acquired conductivity, temperature and depth. To calculate the geopotential anomaly (Φ), it is necessary to first calculate specific volume (δ), as follows (Unesco 1991):

$$\delta = 1 / \rho\,(S,T,p) - 1 / \rho\,(35,0,p) \tag{3}$$

Geopotential is then obtained by integration of specific volume with pressure:

$$-\Phi = \int_0^p \delta \, dp \qquad (4)$$

Geostrophic velocities at pressure p_1 are calculated relative to a reference pressure p_2 by the following formulas (Pond and Pickard, 1983):

$$-f[v_g(p_1) - v_g(p_2)] = -\frac{\partial[\phi(p_1) - \phi(p_2)]}{\partial x}$$
$$f[u_g(p_1) - u_g(p_2)] = -\frac{\partial[(\phi(p_1) - \phi(p_2)]}{\partial y} \qquad (5)$$

The important result of these formulas is a velocity orthogonal to the line connecting the two hydrographic stations. This velocity represents equilibrium between the horizontal pressure gradient and the Coriolis force.

Some problems with geostrophic velocity calculations are:

(i) The solution is a shear or relative velocity so that picking a level of no motion (LNM) is necessary. This is difficult especially close to shore. I used the deepest common depth between stations for ease of

calculation (Robson 1990). I found varying the LNM did not produce significant improvement in the results.

(ii) Data from closely spaced stations poses problems for the analyst. The resulting "noise" requires objective analysis or filtering to discern features within the field. I used stations separated by a distance equal to the radius of deformation for the cruise latitudes. The radius of deformation is that horizontal scale at which rotation effects become as important as buoyancy effects. At this scale Coriolis acceleration is as important as pressure gradients. For these data the radius of deformation varied between 10-30 km. Geostrophic velocity solutions were calculated by selecting station pairs which were at least 15 km apart. This produced fairly smooth portrayals of geostrophic velocity as shown in Figure 18.

b. Geostrophic Velocity and Dynamic Height

Figure 18 represents the mean geostrophic velocity flow along the Pt Sur Section running along 36.20°N. (Again the stations used in calculating this velocity were separated by a distance greater than the radius of deformation thereby in effect filtering out small scale (mesoscale) perturbations.) The positive values of **v** velocity (northerly flow) flow run along the coast out to a distance of 60 km. This flow extends to a depth of over 900 m about 50 km from shore. Onshore of station 8 the maximum northerly velocity is

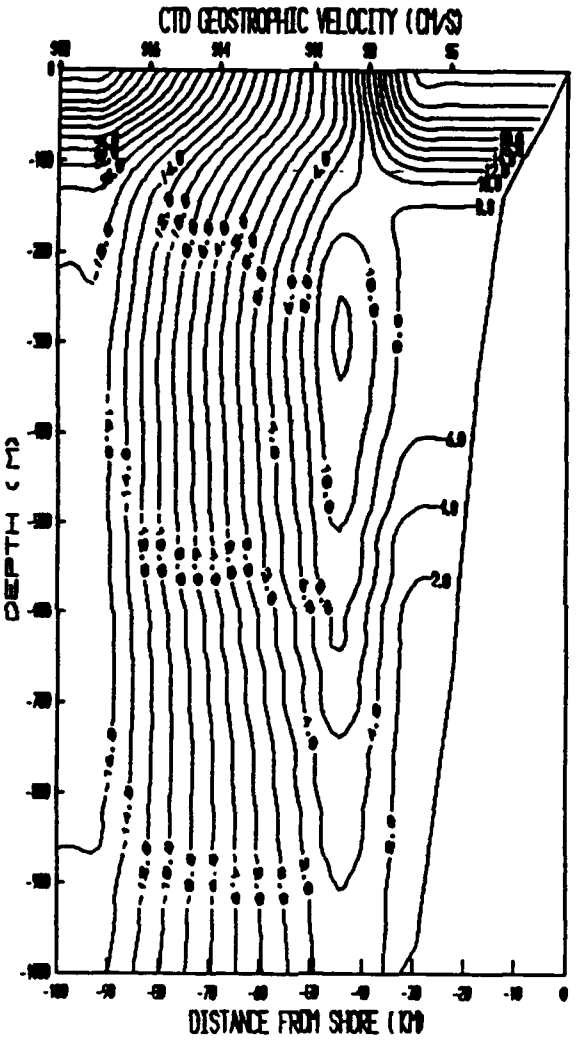

Figure 18 Geostrophic derived v velocity for the Pt. Sur Section (contour interval of 2 cm/s)

24 cm/s along the surface. The deeper core of poleward 12 cm/s flow found at 400 m under station 8 agrees with the Pegasus **v** velocity data in the depth (400 m), intensity of flow (14 cm/s for Pegasus) and general shape of the flow pattern.

At distances greater than 60 km from shore the flow calculated by the geostrophic method reverses direction becoming equatorward contrasting with the poleward flow seen in the Pegasus data. The strongest velocities (40 cm/s) associated with this flow occur at the surface between stations 16 and 18. At depth the geostrophic velocities are greater in magnitude than those measured by Pegasus (16 cm/s vs 2 cm/s at 600 m). Thus, the geostrophic horizontal shear is much greater than observed.

Figure 19 shows the geostrophic velocities calculated between stations along the Canyon section of the transect. The figure in general shows poleward flow between 31 to 105 km from shore. This flow reaches a maximum velocity of 16 cm/s between stations 26 and 29. Weak equatorward flow exists between stations 24 and 25 within 100 m of the surface and below 200 m beneath station 18. The former is associated with upwelling at the mouth of Monterey Bay.

The equatorward flow between stations 29 and 30 within 100 m of the surface reaches a maximum velocity of 17 cm/s. The poleward flowing velocity maximum of 13 cm/s east

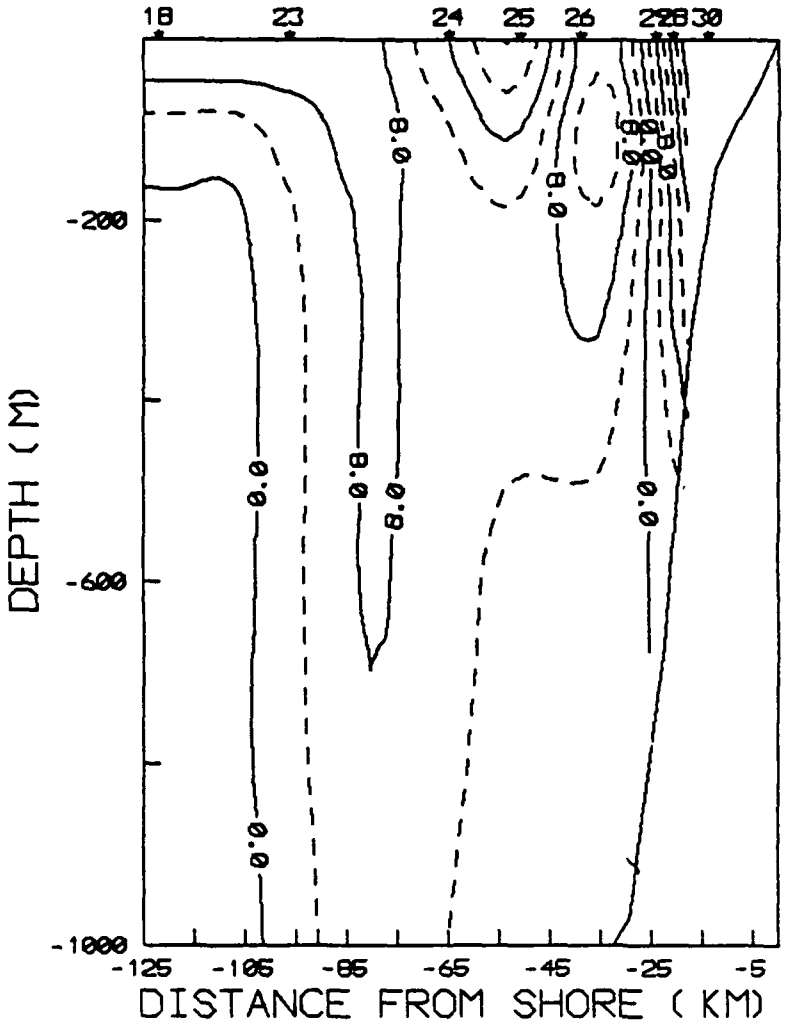

Figure 19 Geostrophic derived v velocity for the Canyon Section (contour interval of 4 cm/s)

of station 26 from the surface to 200 m may be associated with the undercurrent.

3. A Comparison of Pegasus and Geostrophic Derived Velocity

A comparison between Pegasus (figure 14) and Geostrophic (figure 18) derived **v** velocities shows good agreement in the location and velocity of the California Undercurrent off Pt. Sur.

Pegasus derived velocity shows the core of the California Undercurrent located 41 km from shore at depths between 250 and 600 m. It reaches a maximum velocity of 14 cm/s at a depth of 475 m. Geostrophic derived **v** velocities for the Pt. Sur Section place the core of the California Undercurrent 44 km from shore at depths between 200 and 600 m. A maximum velocity of 12 cm/s is found at a depth of 300 m. Comparing Pegasus derived **v** velocities to geostrophic velocities west of 50 km from shore, the geostrophic method failed to show the poleward surface flow measured by Pegasus. It did show surface velocities in excess of 20 cm/s further than 80 km from shore which did agree with Pegasus derived data.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Berryman (1989) analyzed data collected from 2-7 February 1989 by the **R. V. Pt. Sur**. The average SST of the area during the collection period was 11°C. By 25-29 March the average SST had increased to 12°C. Vertical temperatures along the Pt. Sur Section in both February and March showed strong stratification down to the 9.5°C isotherm at a depth of 150 m to a distance of 80 km from shore. This trend continued in the February data the full length of the section. However in the March transection cold surface water (associated with the filament and cyclonic eddy described previously) between stations 16 and 20 dominated the western portion of the section. These colder waters resulted in an increase of the vertical temperature gradient in the western half of the section causing the 9.5°C isotherm to upwell to a depth of 50 meters.

The velocity transections of the February 1989 cruise placed the California Undercurrent 20-40 km offshore with a velocity of approximately 24 cm/s. The current extended from the surface to a depth of 500 m. By March velocity data showed the core of the California Undercurrent was located 41 km from shore at depths between 250 and 600 m. The current

had a slower maximum velocity than that in February of 14 cm/s at a depth of 475 m.

Both the February and March Pegasus velocity transections showed a deepwater (800 m) southward moving jet located 33 km from shore. Berryman described this feature as part of a topographically steered "Trench Jet" system related to winter flow out of the Monterey Bay.

An unexpected difference in the March 1989 data from that collected in February, was the presence of a cyclonic eddy in the outermost region of the Point Sur section. The satellite imagery in Figure 3 shows the cyclonic nature of the waters at that location. Evaluation of temperature, salinity, and density fields attest to a relatively shallow, dense feature of baroclinic nature. Pegasus derived velocity fields measured at station 16 depict poleward flow with surface speeds of 24 cm/s.

In the Canyon section the undercurrent signature is further offshore (70 km). Robson (1990) considered the effects of bathymetry on the path of the undercurrent. He concluded that the undercurrent includes a western component caused by deflection of the current by the broadened continental margin offshore of Pt. Sur. My analysis supports his conclusion.

B. RECOMMENDATIONS

Water samples are collected at each CTD station but I have made no attempt to analyze them. Dissolved oxygen as a tracer is normal to oceanographic work and would be useful in distinguishing water of tropical origin from subarctic formed water.

Extra CTD or Pegasus stations should be added between the present two sections so that more horizontal resolution of data can be evaluated. The question of how bathymetry plays a role in the dynamics of the undercurrent flow requires a better horizontal picture in order to be answered. The contouring packages used on the NPS mainframe computer and the SURFER contouring package for the PC tend to extrapolate where they lack data but the solutions they generate in these cases often are not realistic depictions.

APPENDIX A. STATION LISTINGS

Listing of CTD data collected during the March 1989 California Undercurrent cruise are provided here. Thermodynamic proerties have been derived using the 1980 equation of state (Unesco, 1991). For reference, some of the abbreviations used are as follows:

P(dbar) = pressure in dbar

T(°C) = temperature in °C

S(psu) = salinity in psu

γ_θ(kg m^{-3}) = density anomaly in kg/m^3

δ = specific volume anomaly in $10^{-8}m^3/kg$

$\Sigma\Delta D$ = dynamic height respect to the surface in dynamic meters (10 m^2s^{-2})

π = spiciness

STATION: 0 DATE: 3/25/89 0348 GMT
LAT: 36° 33.2′ N. LON: 122° 1.7′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	11.649	33.359	25.381	258.56	0.000	0.14
5.0	11.648	33.365	25.386	258.18	0.013	0.14
10.0	11.633	33.401	25.417	255.38	0.026	0.17
15.0	11.489	33.475	25.500	247.53	0.038	0.20
20.0	11.184	33.520	25.591	239.04	0.051	0.18
25.0	10.662	33.586	25.735	225.43	0.062	0.14
30.0	10.106	33.670	25.897	210.16	0.073	0.10
35.0	9.856	33.725	25.982	202.19	0.083	0.10
40.0	9.740	33.749	26.020	198.67	0.093	0.10
45.0	9.663	33.765	26.045	196.33	0.103	0.10
50.0	9.536	33.786	26.082	192.92	0.113	0.10
60.0	9.099	33.799	26.164	185.34	0.132	0.04
70.0	8.930	33.826	26.211	181.01	0.150	0.03
80.0	8.918	33.882	26.257	176.84	0.168	0.07
90.0	9.017	33.914	26.267	176.17	0.186	0.12
100.0	9.007	33.938	26.287	174.39	0.203	0.13
125.0	8.676	34.009	26.395	164.59	0.245	0.14
150.0	8.510	34.030	26.438	160.99	0.285	0.13
175.0	8.481	34.036	26.447	160.56	0.326	0.13
200.0	8.261	34.066	26.505	155.51	0.365	0.12
225.0	8.173	34.075	26.526	153.94	0.404	0.11
250.0	7.935	34.085	26.569	150.20	0.442	0.08
275.0	7.842	34.088	26.585	149.02	0.480	0.07
300.0	7.509	34.103	26.645	143.56	0.516	0.03
325.0	7.160	34.123	26.711	137.55	0.551	0.00
350.0	6.989	34.133	26.742	134.86	0.585	-.02
375.0	6.790	34.154	26.786	130.92	0.619	-.03
400.0	6.665	34.166	26.812	128.72	0.651	-.03
425.0	6.500	34.180	26.846	125.80	0.683	-.05
450.0	6.342	34.196	26.879	122.88	0.714	-.05
475.0	6.179	34.211	26.912	119.97	0.744	-.06
500.0	6.003	34.228	26.948	116.70	0.774	-.07
550.0	5.666	34.266	27.020	110.17	0.831	-.08
600.0	5.368	34.304	27.086	104.16	0.884	-.09
650.0	5.143	34.331	27.135	99.90	0.935	-.10
700.0	4.948	34.351	27.173	96.55	0.984	-.10
750.0	4.893	34.359	27.186	95.80	1.032	-.10
800.0	4.673	34.382	27.229	91.90	1.079	-.11
835.4	4.475	34.402	27.267	88.34	1.111	-.12

STATION: 1 DATE: 3/25/89 0636 GMT
LAT: 36° 20.2′ N. LON: 121° 56.3′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	11.909	33.401	25.365	260.05	0.000	0.22
5.0	11.463	33.476	25.506	246.77	0.013	0.20
10.0	10.799	33.627	25.743	224.38	0.025	0.19
15.0	10.650	33.668	25.801	218.96	0.036	0.20
20.0	10.518	33.705	25.853	214.09	0.046	0.20
25.0	10.489	33.715	25.866	213.01	0.057	0.21
30.0	10.402	33.725	25.888	210.96	0.068	0.20
35.0	10.359	33.729	25.899	210.05	0.078	0.19
40.0	10.349	33.731	25.903	209.78	0.089	0.19
45.0	10.320	33.742	25.917	208.62	0.099	0.20
50.0	10.181	33.778	25.968	203.82	0.110	0.20
53.6	10.067	33.790	25.997	201.12	0.117	0.19

STATION: 2 DATE: 3/25/89 0718 GMT
LAT: 36° 20.2′ N. LON: 121° 59.2′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	11.954	33.381	25.341	262.33	0.000	0.21
5.0	11.954	33.381	25.341	262.44	0.013	0.21
10.0	11.935	33.383	25.346	262.08	0.026	0.21
15.0	11.893	33.385	25.356	261.25	0.039	0.20
20.0	11.837	33.388	25.369	260.16	0.052	0.20
25.0	11.721	33.402	25.401	257.20	0.065	0.18
30.0	11.509	33.447	25.475	250.29	0.078	0.18
35.0	11.124	33.513	25.597	238.85	0.090	0.16
40.0	10.891	33.535	25.655	233.39	0.102	0.14
45.0	10.486	33.585	25.766	222.95	0.113	0.10
50.0	10.370	33.603	25.799	219.85	0.124	0.10
60.0	9.958	33.670	25.922	208.42	0.146	0.08
70.0	9.724	33.737	26.013	199.91	0.166	0.09
80.0	9.634	33.770	26.054	196.21	0.186	0.10
89.6	9.148	33.910	26.243	178.43	0.204	0.13

STATION: 3 DATE: 3/25/89 0753 GMT
LAT: 36° 20.1′ N. LON: 122° 2.0′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.340	33.332	25.230	272.90	0.000	0.25
5.0	12.323	33.335	25.235	272.50	0.014	0.25
10.0	12.264	33.343	25.253	270.96	0.027	0.24
15.0	12.001	33.369	25.323	264.42	0.041	0.21
20.0	11.867	33.385	25.361	260.92	0.054	0.20
25.0	11.749	33.399	25.394	257.93	0.067	0.19
30.0	11.541	33.422	25.450	252.70	0.079	0.17
35.0	11.406	33.438	25.488	249.22	0.092	0.15
40.0	11.289	33.456	25.522	246.02	0.104	0.15
45.0	11.121	33.483	25.574	241.25	0.117	0.14
50.0	10.880	33.517	25.644	234.68	0.128	0.12
60.0	10.069	33.610	25.856	214.64	0.151	0.05
70.0	9.575	33.710	26.017	199.56	0.172	0.05
80.0	9.357	33.792	26.117	190.20	0.191	0.07
90.0	9.288	33.852	26.175	184.93	0.210	0.11
100.0	9.102	33.933	26.268	176.23	0.228	0.14
125.6	8.858	33.997	26.358	168.22	0.271	0.16

STATION: 4 DATE: 3/25/89 0830 GMT
LAT: 36° 20.1′ N. LON: 122° 5.3′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.625	33.283	25.137	281.74	0.000	0.27
5.0	12.533	33.289	25.160	279.69	0.014	0.25
10.0	12.105	33.352	25.290	267.42	0.028	0.22
15.0	12.011	33.366	25.319	264.77	0.041	0.21
20.0	11.938	33.374	25.339	263.03	0.054	0.20
25.0	11.560	33.408	25.436	253.91	0.067	0.16
30.0	11.293	33.443	25.512	246.81	0.080	0.14
35.0	11.126	33.463	25.557	242.60	0.092	0.12
40.0	10.779	33.500	25.648	234.03	0.104	0.09
45.0	10.523	33.544	25.727	226.66	0.115	0.08
50.0	10.240	33.594	25.815	218.40	0.126	0.07
60.0	9.759	33.680	25.963	204.43	0.148	0.05
70.0	9.644	33.704	26.001	201.05	0.168	0.05
80.0	9.455	33.734	26.056	196.03	0.188	0.04
90.0	9.201	33.870	26.203	182.20	0.207	0.11
100.0	9.137	33.939	26.268	176.28	0.225	0.15
125.0	8.938	33.998	26.346	169.34	0.268	0.17
150.0	8.767	34.013	26.385	166.10	0.310	0.15
175.0	8.530	34.064	26.462	159.19	0.350	0.16
200.0	8.321	34.089	26.513	154.70	0.390	0.14
225.0	8.198	34.096	26.538	152.78	0.428	0.13
250.0	7.830	34.116	26.608	146.38	0.466	0.09
268.4	7.769	34.117	26.618	145.72	0.492	0.08

STATION: 5 DATE: 3/25/89 0911 GMT

LAT: 36° 20.1′ N. LON: 122° 8.6′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.5	12.686	33.277	25.120	283.32	0.001	0.27
5.0	12.687	33.293	25.133	282.29	0.014	0.29
10.0	12.671	33.293	25.136	282.09	0.028	0.28
15.0	12.606	33.294	25.149	280.95	0.042	0.27
20.0	12.184	33.323	25.253	271.22	0.056	0.21
25.0	12.059	33.344	25.293	267.49	0.070	0.20
30.0	11.894	33.355	25.332	263.88	0.083	0.18
35.0	11.389	33.381	25.446	253.13	0.096	0.11
40.0	11.159	33.427	25.524	245.88	0.108	0.10
45.0	11.112	33.473	25.568	241.82	0.120	0.13
50.0	11.050	33.526	25.621	236.92	0.132	0.16
60.0	10.806	33.566	25.695	230.08	0.156	0.14
70.0	10.447	33.626	25.805	219.80	0.178	0.13
80.0	10.041	33.659	25.900	210.93	0.200	0.08
90.0	9.724	33.754	26.027	199.01	0.220	0.10
100.0	9.708	33.790	26.058	196.28	0.240	0.13
125.0	8.884	33.856	26.243	179.04	0.286	0.05
150.0	8.712	33.978	26.366	167.86	0.329	0.12
175.0	8.550	34.044	26.443	160.98	0.370	0.14
200.0	8.382	34.071	26.490	156.93	0.410	0.14
225.0	8.158	34.102	26.548	151.78	0.449	0.13
250.0	7.931	34.126	26.602	147.08	0.486	0.11
275.0	7.634	34.120	26.640	143.66	0.522	0.07
300.0	7.376	34.139	26.692	139.02	0.558	0.04
325.0	7.107	34.144	26.734	135.26	0.592	0.01
350.0	6.846	34.159	26.782	131.01	0.625	-.02
375.0	6.581	34.182	26.836	126.06	0.657	-.03
400.0	6.333	34.201	26.884	121.69	0.688	-.05
425.0	6.167	34.217	26.918	118.68	0.718	-.06
450.0	6.054	34.227	26.940	116.83	0.748	-.07
475.0	5.921	34.247	26.973	113.88	0.777	-.07
500.0	5.734	34.266	27.011	110.42	0.805	-.08
550.0	5.569	34.290	27.051	107.15	0.859	-.08
600.0	5.337	34.320	27.103	102.60	0.912	-.08
620.2	5.279	34.328	27.116	101.49	0.932	-.08

STATION: 6 DATE: 3/25/89 1048 GMT

LAT: 36° 20.0' N. LON: 122° 13.0' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.611	33.270	25.130	282.44	0.000	0.25
5.0	12.611	33.270	25.130	282.55	0.014	0.25
10.0	12.566	33.279	25.146	281.18	0.028	0.25
15.0	12.504	33.288	25.165	279.50	0.042	0.25
20.0	12.438	33.309	25.194	276.85	0.056	0.25
25.0	12.290	33.323	25.233	273.25	0.070	0.23
30.0	11.901	33.366	25.340	263.17	0.083	0.19
35.0	11.321	33.365	25.446	253.14	0.096	0.08
40.0	11.282	33.369	25.456	252.34	0.109	0.08
45.0	11.116	33.380	25.495	248.74	0.121	0.05
50.0	10.927	33.409	25.551	243.48	0.134	0.04
60.0	10.712	33.468	25.635	235.69	0.158	0.05
70.0	10.334	33.590	25.796	220.62	0.180	0.08
80.0	10.229	33.680	25.884	212.43	0.202	0.13
90.0	10.087	33.692	25.918	209.40	0.223	0.12
100.0	9.922	33.701	25.953	206.27	0.244	0.10
125.0	9.229	33.841	26.177	185.42	0.293	0.09
150.0	8.354	33.945	26.395	164.99	0.336	0.04
175.0	7.987	33.986	26.482	157.07	0.376	0.01
200.0	7.761	34.007	26.532	152.67	0.415	-.01
225.0	7.490	34.017	26.580	148.48	0.453	-.04
250.0	7.305	34.039	26.623	144.70	0.489	-.05
275.0	7.211	34.076	26.665	141.03	0.525	-.03
300.0	7.163	34.126	26.712	136.99	0.559	0.00
325.0	7.023	34.157	26.756	133.15	0.593	0.01
350.0	6.743	34.158	26.795	129.62	0.626	-.03
375.0	6.539	34.153	26.818	127.64	0.658	-.06
400.0	6.477	34.196	26.860	124.01	0.690	-.04
425.0	6.443	34.212	26.878	122.65	0.720	-.03
450.0	6.321	34.218	26.899	120.96	0.751	-.04
475.0	6.208	34.228	26.922	119.06	0.781	-.05
500.0	6.137	34.241	26.941	117.48	0.811	-.05
550.0	5.876	34.259	26.989	113.35	0.868	-.06
600.0	5.423	34.266	27.050	107.67	0.923	-.11
650.0	5.176	34.304	27.109	102.35	0.976	-.11
700.0	5.021	34.346	27.161	97.82	1.025	-.10
750.0	4.874	34.363	27.192	95.27	1.074	-.10
800.0	4.720	34.384	27.226	92.33	1.121	-.10
850.0	4.516	34.405	27.265	88.76	1.166	-.11
891.7	4.363	34.421	27.295	86.11	1.202	-.11

STATION: 7 DATE: 3/25/89 1218 GMT

LAT: 36° 20.0′ N. LON: 122° 15.1′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.535	33.274	25.147	280.74	0.000	0.24
5.0	12.536	33.275	25.148	280.81	0.014	0.24
10.0	12.538	33.275	25.148	280.95	0.028	0.24
15.0	12.537	33.275	25.148	281.07	0.042	0.24
20.0	12.536	33.276	25.149	281.09	0.056	0.24
25.0	12.527	33.275	25.151	281.07	0.070	0.24
30.0	12.497	33.278	25.159	280.43	0.084	0.24
35.0	12.372	33.315	25.212	275.53	0.098	0.24
40.0	12.123	33.354	25.289	268.29	0.112	0.22
45.0	11.333	33.370	25.448	253.22	0.125	0.09
50.0	11.326	33.404	25.476	250.70	0.137	0.11
60.0	11.222	33.452	25.533	245.53	0.162	0.13
70.0	10.563	33.503	25.688	230.87	0.186	0.05
80.0	10.303	33.576	25.791	221.34	0.209	0.06
90.0	10.143	33.680	25.899	211.23	0.230	0.12
100.0	9.910	33.711	25.963	205.36	0.251	0.10
125.0	8.985	33.805	26.187	184.41	0.300	0.02
150.0	8.630	33.911	26.326	171.59	0.344	0.05
175.0	8.231	33.966	26.430	162.08	0.385	0.03
200.0	7.936	33.995	26.497	156.06	0.425	0.01
225.0	7.688	34.011	26.546	151.71	0.464	-.01
250.0	7.314	34.023	26.609	146.01	0.501	-.06
275.0	7.123	34.050	26.657	141.76	0.537	-.06
300.0	7.094	34.084	26.689	139.17	0.572	-.04
325.0	6.928	34.126	26.744	134.22	0.606	-.03
350.0	6.878	34.168	26.785	130.74	0.639	0.00
375.0	6.617	34.177	26.827	126.91	0.671	-.03
400.0	6.504	34.210	26.869	123.26	0.703	-.02
425.0	6.285	34.228	26.911	119.38	0.733	-.04
450.0	6.195	34.238	26.931	117.84	0.763	-.04
475.0	6.135	34.241	26.941	117.17	0.792	-.05
500.0	6.033	34.246	26.958	115.75	0.821	-.05
550.0	5.779	34.262	27.003	111.91	0.878	-.07
600.0	5.429	34.261	27.045	108.15	0.933	-.12
650.0	5.184	34.309	27.113	102.02	0.986	-.11
700.0	4.957	34.345	27.167	97.10	1.036	-.11
750.0	4.797	34.373	27.208	93.58	1.083	-.10
800.0	4.622	34.392	27.243	90.53	1.129	-.11
850.0	4.436	34.411	27.278	87.38	1.174	-.11
900.0	4.307	34.425	27.304	85.21	1.217	-.12
950.0	4.197	34.436	27.325	83.52	1.259	-.12
978.1	4.180	34.438	27.328	83.42	1.282	-.12

STATION: 8 DATE: 3/25/89 1248 GMT
LAT: 36° 20.1' N. LON: 122° 19.1' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.491	33.277	25.158	279.71	0.000	0.24
5.0	12.496	33.277	25.157	279.96	0.014	0.24
10.0	12.494	33.277	25.158	280.00	0.028	0.24
15.0	12.475	33.280	25.164	279.58	0.042	0.23
20.0	12.452	33.281	25.169	279.17	0.056	0.23
25.0	12.399	33.285	25.182	278.06	0.070	0.22
30.0	12.390	33.289	25.188	277.67	0.084	0.22
35.0	12.390	33.291	25.189	277.64	0.098	0.23
40.0	12.348	33.297	25.202	276.60	0.112	0.22
45.0	11.523	33.314	25.370	260.69	0.125	0.08
50.0	11.286	33.371	25.457	252.44	0.138	0.08
60.0	11.086	33.399	25.515	247.15	0.163	0.06
70.0	10.969	33.417	25.550	244.03	0.187	0.06
80.0	10.745	33.460	25.623	237.30	0.211	0.05
90.0	10.547	33.544	25.724	227.97	0.235	0.08
100.0	10.295	33.580	25.795	221.33	0.257	0.06
125.0	9.602	33.780	26.069	195.79	0.309	0.10
150.0	8.815	33.913	26.299	174.23	0.355	0.08
175.0	8.265	33.970	26.428	162.28	0.396	0.04
200.0	8.012	33.999	26.489	156.86	0.436	0.03
225.0	7.779	34.009	26.532	153.15	0.475	0.00
250.0	7.422	34.019	26.591	147.80	0.513	-.05
275.0	7.184	34.034	26.636	143.78	0.549	-.07
300.0	6.872	34.050	26.692	138.72	0.584	-.10
325.0	6.801	34.085	26.730	135.49	0.618	-.08
350.0	6.526	34.090	26.770	131.83	0.652	-.11
375.0	6.418	34.126	26.813	128.07	0.684	-.10
400.0	6.231	34.130	26.841	125.64	0.716	-.12
425.0	6.351	34.191	26.874	123.00	0.747	-.06
450.0	6.260	34.223	26.911	119.79	0.777	-.04
475.0	6.137	34.239	26.939	117.31	0.807	-.05
500.0	6.048	34.246	26.956	115.95	0.836	-.05
550.0	5.778	34.268	27.008	111.45	0.893	-.07
600.0	5.584	34.287	27.047	108.16	0.948	-.08
650.0	5.326	34.303	27.091	104.27	1.001	-.10
700.0	5.058	34.335	27.148	99.09	1.052	-.10
750.0	4.832	34.366	27.199	94.53	1.100	-.10
800.0	4.521	34.401	27.261	88.63	1.145	-.11
850.0	4.346	34.419	27.295	85.67	1.189	-.12
899.9	4.167	34.435	27.327	82.79	1.231	-.12

STATION: 9 DATE: 3/25/89 1630 GMT

LAT: 36° 20.1′ N. LON: 122° 22.1′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.484	33.270	25.154	280.10	0.000	0.23
5.0	12.485	33.275	25.158	279.87	0.014	0.23
10.0	12.488	33.286	25.166	279.20	0.028	0.24
15.0	12.446	33.286	25.175	278.54	0.042	0.23
20.0	12.356	33.284	25.190	277.20	0.056	0.21
25.0	12.350	33.285	25.192	277.09	0.070	0.21
30.0	12.344	33.288	25.196	276.93	0.084	0.21
35.0	12.345	33.289	25.197	276.95	0.097	0.22
40.0	12.341	33.291	25.199	276.84	0.111	0.22
45.0	12.207	33.313	25.241	272.95	0.125	0.21
50.0	11.706	33.369	25.379	259.93	0.138	0.15
60.0	11.317	33.448	25.512	247.51	0.164	0.14
70.0	11.130	33.519	25.601	239.25	0.188	0.17
80.0	10.896	33.538	25.658	234.06	0.212	0.14
90.0	10.311	33.573	25.787	221.93	0.235	0.06
100.0	9.967	33.697	25.942	207.34	0.256	0.10
125.0	9.402	33.860	26.163	186.77	0.305	0.13
150.0	8.638	33.925	26.336	170.68	0.350	0.06
175.0	8.203	33.977	26.443	160.86	0.391	0.04
200.0	7.926	33.996	26.500	155.80	0.431	0.01
225.0	7.703	34.010	26.543	152.04	0.469	-.01
250.0	7.355	34.021	26.602	146.73	0.506	-.05
275.0	7.197	34.038	26.638	143.64	0.543	-.06
300.0	6.981	34.039	26.668	140.99	0.578	-.09
325.0	6.763	34.059	26.714	136.94	0.613	-.11
350.0	6.709	34.140	26.786	130.51	0.647	-.05
375.0	6.272	34.129	26.834	125.90	0.679	-.11
400.0	6.027	34.155	26.886	121.16	0.710	-.13
425.0	6.177	34.230	26.926	117.87	0.740	-.05
450.0	6.010	34.244	26.959	114.97	0.769	-.06
475.0	5.892	34.254	26.982	113.05	0.797	-.07
500.0	5.746	34.256	27.002	111.31	0.825	-.08
550.0	5.593	34.281	27.041	108.13	0.880	-.08
600.0	5.336	34.297	27.084	104.32	0.933	-.10
650.0	5.157	34.334	27.136	99.83	0.984	-.09
700.0	5.013	34.357	27.171	96.89	1.033	-.09
750.0	4.846	34.364	27.195	94.86	1.081	-.10
800.0	4.669	34.385	27.232	91.64	1.127	-.11
850.0	4.547	34.401	27.259	89.44	1.173	-.11
900.0	4.393	34.418	27.289	86.77	1.217	-.11
950.0	4.187	34.436	27.326	83.41	1.260	-.12
1000.0	4.058	34.449	27.350	81.33	1.301	-.12
1100.0	3.723	34.479	27.408	75.93	1.379	-.13
1200.0	3.551	34.495	27.438	73.47	1.454	-.14

STATION: 10 DATE: 3/25/89 2000 GMT
LAT: 36° 20.0′ N. LON: 122° 25.6′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.628	33.273	25.129	282.53	0.000	0.26
5.0	12.628	33.274	25.129	282.60	0.014	0.26
10.0	12.568	33.275	25.142	281.50	0.028	0.25
15.0	12.538	33.276	25.149	280.98	0.042	0.24
20.0	12.493	33.281	25.161	279.92	0.056	0.24
25.0	12.393	33.288	25.186	277.69	0.070	0.22
30.0	12.340	33.295	25.202	276.30	0.084	0.22
35.0	12.311	33.297	25.209	275.74	0.098	0.22
40.0	12.255	33.307	25.227	274.15	0.112	0.21
45.0	11.911	33.355	25.330	264.48	0.125	0.18
50.0	11.484	33.405	25.448	253.40	0.138	0.14
60.0	11.319	33.519	25.567	242.27	0.163	0.20
70.0	10.894	33.506	25.633	236.18	0.187	0.11
80.0	10.598	33.568	25.733	226.84	0.210	0.11
90.0	9.996	33.612	25.871	213.87	0.232	0.04
100.0	9.652	33.683	25.984	203.31	0.253	0.04
125.0	9.038	33.804	26.178	185.26	0.301	0.03
150.0	8.832	33.878	26.269	177.09	0.346	0.06
175.0	8.616	33.948	26.358	169.05	0.389	0.08
200.0	8.124	33.975	26.453	160.28	0.431	0.02
225.0	7.855	33.992	26.507	155.52	0.470	0.00
250.0	7.569	34.005	26.559	150.89	0.508	-.04
275.0	7.312	34.017	26.605	146.80	0.546	-.06
300.0	7.097	34.042	26.655	142.37	0.582	-.07
325.0	6.859	34.045	26.690	139.25	0.617	-.10
350.0	6.721	34.079	26.736	135.22	0.651	-.10
375.0	6.566	34.113	26.783	130.99	0.684	-.09
400.0	6.282	34.117	26.824	127.28	0.717	-.12
425.0	6.013	34.136	26.873	122.71	0.748	-.14
450.0	5.847	34.142	26.899	120.46	0.778	-.16
475.0	5.740	34.163	26.929	117.85	0.808	-.16
500.0	5.764	34.206	26.960	115.26	0.837	-.12
550.0	5.650	34.265	27.022	110.00	0.893	-.09
600.0	5.316	34.274	27.069	105.74	0.947	-.12
700.0	5.042	34.337	27.151	98.75	1.049	-.10
750.0	4.781	34.359	27.199	94.42	1.097	-.12
800.0	4.564	34.368	27.230	91.61	1.143	-.13
900.0	4.341	34.408	27.287	86.90	1.233	-.13
950.0	4.181	34.426	27.318	84.08	1.275	-.13
1000.0	4.007	34.446	27.353	80.93	1.316	-.13
1100.0	3.805	34.465	27.389	77.95	1.396	-.14
1200.0	3.540	34.484	27.431	74.15	1.472	-.15
1300.0	3.292	34.508	27.474	70.14	1.544	-.15
1400.0	3.100	34.522	27.504	67.49	1.612	-.16
1500.0	2.944	34.535	27.529	65.29	1.679	-.16
1600.0	2.761	34.550	27.557	62.58	1.743	-.17
1663.9	2.657	34.559	27.574	61.04	1.782	-.17

STATION: 11 DATE: 3/25/89 2148 GMT

LAT: 36° 20.0′ N. LON: 122° 28.9′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.615	33.287	25.142	281.26	0.000	0.27
5.0	12.610	33.288	25.144	281.23	0.014	0.27
10.0	12.568	33.291	25.154	280.35	0.028	0.26
15.0	12.510	33.297	25.171	278.92	0.042	0.25
20.0	12.479	33.300	25.179	278.24	0.056	0.25
25.0	12.317	33.310	25.217	274.72	0.070	0.23
30.0	12.231	33.326	25.247	272.02	0.084	0.22
35.0	11.685	33.433	25.432	254.49	0.097	0.20
40.0	11.608	33.478	25.481	249.96	0.109	0.22
45.0	11.565	33.521	25.523	246.11	0.122	0.25
50.0	11.467	33.531	25.549	243.77	0.134	0.24
60.0	11.194	33.520	25.590	240.04	0.158	0.18
70.0	10.969	33.511	25.624	237.06	0.182	0.13
80.0	10.505	33.520	25.712	228.83	0.205	0.05
90.0	10.109	33.567	25.817	219.04	0.228	0.02
100.0	9.768	33.660	25.947	206.88	0.249	0.04
125.0	9.045	33.795	26.169	186.08	0.297	0.02
150.0	8.785	33.877	26.275	176.44	0.342	0.05
175.0	8.481	33.946	26.377	167.22	0.385	0.05
200.0	8.210	33.977	26.443	161.35	0.426	0.04
225.0	7.826	33.995	26.514	154.88	0.466	-.01
250.0	7.520	34.009	26.569	149.92	0.504	-.04
275.0	7.098	34.015	26.633	144.02	0.540	-.09
300.0	6.844	34.035	26.684	139.47	0.576	-.11
325.0	6.624	34.075	26.745	133.89	0.610	-.11
350.0	6.462	34.092	26.780	130.84	0.643	-.12
375.0	6.152	34.104	26.830	126.22	0.675	-.15
400.0	6.009	34.114	26.856	124.01	0.706	-.16
425.0	5.935	34.147	26.891	120.91	0.737	-.14
450.0	5.770	34.166	26.927	117.71	0.767	-.15
475.0	5.667	34.189	26.958	114.98	0.796	-.14
500.0	5.579	34.206	26.983	112.92	0.824	-.14
550.0	5.396	34.246	27.036	108.26	0.880	-.13
600.0	5.172	34.281	27.091	103.40	0.932	-.13
700.0	4.944	34.342	27.166	97.18	1.032	-.11
800.0	4.566	34.391	27.248	89.93	1.126	-.11
900.0	4.242	34.424	27.310	84.52	1.213	-.12
1000.0	3.977	34.444	27.354	80.72	1.296	-.14
1100.0	3.708	34.469	27.402	76.49	1.374	-.14
1200.0	3.494	34.488	27.438	73.29	1.449	-.15
1300.0	3.279	34.506	27.474	70.12	1.521	-.16
1400.0	3.031	34.528	27.515	66.22	1.589	-.16
1500.0	2.837	34.544	27.545	63.36	1.654	-.17
1600.0	2.690	34.557	27.569	61.22	1.716	-.17
1700.0	2.571	34.566	27.587	59.68	1.777	-.17
1800.0	2.460	34.577	27.606	58.05	1.835	-.17
1869.4	2.308	34.592	27.631	55.44	1.874	-.17

STATION: 12 DATE: 3/26/89 0836 GMT

LAT: 36° 20.1′ N. LON: 122° 33.1′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.474	33.306	25.184	277.26	0.000	0.25
5.0	12.475	33.305	25.183	277.49	0.014	0.25
10.0	12.478	33.305	25.183	277.66	0.028	0.25
15.0	12.478	33.304	25.182	277.81	0.042	0.25
20.0	12.478	33.304	25.182	277.96	0.056	0.25
25.0	12.477	33.304	25.183	278.02	0.069	0.25
30.0	12.446	33.306	25.190	277.43	0.083	0.25
35.0	12.330	33.317	25.221	274.61	0.097	0.23
40.0	12.258	33.326	25.242	272.76	0.111	0.23
45.0	11.910	33.449	25.403	257.57	0.124	0.26
50.0	11.651	33.505	25.495	248.93	0.137	0.25
60.0	11.526	33.522	25.531	245.72	0.161	0.24
70.0	11.266	33.557	25.606	238.80	0.186	0.22
80.0	10.896	33.596	25.703	229.77	0.209	0.18
90.0	10.320	33.645	25.842	216.72	0.231	0.12
100.0	9.877	33.668	25.934	208.04	0.253	0.06
125.0	8.988	33.792	26.176	185.41	0.302	0.01
150.0	8.569	33.912	26.336	170.61	0.346	0.04
175.0	8.270	33.955	26.416	163.43	0.388	0.03
200.0	7.910	33.997	26.503	155.54	0.428	0.01
225.0	7.745	34.007	26.535	152.87	0.466	-.01
250.0	7.285	34.009	26.602	146.66	0.504	-.07
275.0	7.076	34.024	26.643	143.06	0.540	-.09
300.0	6.829	34.048	26.696	138.28	0.575	-.10
350.0	6.523	34.071	26.755	133.20	0.643	-.13
375.0	6.281	34.075	26.791	130.03	0.676	-.16
400.0	6.147	34.096	26.824	127.12	0.708	-.16
450.0	5.808	34.139	26.901	120.20	0.769	-.17
500.0	5.675	34.180	26.950	116.06	0.828	-.15
550.0	5.434	34.225	27.015	110.29	0.885	-.14
600.0	5.244	34.263	27.068	105.67	0.939	-.14
700.0	4.935	34.338	27.165	97.33	1.041	-.11
750.0	4.736	34.365	27.208	93.43	1.088	-.12
800.0	4.573	34.383	27.241	90.61	1.134	-.12
850.0	4.459	34.399	27.267	88.52	1.179	-.12
900.0	4.275	34.411	27.296	85.86	1.223	-.13
950.0	4.115	34.422	27.322	83.59	1.265	-.14
1000.0	3.977	34.443	27.353	80.80	1.306	-.14
1100.0	3.691	34.464	27.399	76.65	1.385	-.15
1200.0	3.441	34.491	27.446	72.46	1.459	-.15
1400.0	2.988	34.526	27.517	65.85	1.597	-.17
1600.0	2.665	34.556	27.570	61.00	1.725	-.17
1800.0	2.371	34.584	27.619	56.45	1.841	-.18
2000.0	2.099	34.613	27.665	51.94	1.949	-.18
2100.0	2.017	34.620	27.677	50.82	2.000	-.18
2200.0	1.957	34.630	27.691	49.75	2.050	-.17
2259.4	1.868	34.637	27.703	48.35	2.080	-.18

STATION: 13 DATE: 3/26/89 1200 GMT

LAT: 36 20.0' N. LON: 122 35.6' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.476	33.305	25.183	277.37	0.000	0.25
5.0	12.476	33.305	25.183	277.46	0.014	0.25
10.0	12.478	33.306	25.183	277.57	0.028	0.26
15.0	12.476	33.306	25.184	277.65	0.042	0.25
20.0	12.473	33.306	25.185	277.72	0.056	0.25
25.0	12.475	33.307	25.185	277.79	0.069	0.26
30.0	12.473	33.307	25.186	277.82	0.083	0.25
35.0	12.365	33.322	25.218	274.92	0.097	0.25
40.0	11.876	33.432	25.396	258.07	0.111	0.24
45.0	11.603	33.508	25.506	247.74	0.123	0.25
50.0	11.526	33.520	25.530	245.60	0.135	0.24
60.0	11.362	33.546	25.580	241.05	0.160	0.23
70.0	11.105	33.537	25.619	237.52	0.184	0.18
80.0	10.767	33.560	25.698	230.23	0.207	0.13
90.0	10.246	33.583	25.806	220.12	0.230	0.06
100.0	9.570	33.675	25.991	202.63	0.251	0.02
125.0	8.894	33.819	26.213	181.93	0.298	0.02
150.0	8.635	33.916	26.329	171.30	0.342	0.06
175.0	8.252	33.939	26.406	164.39	0.384	0.01
200.0	7.908	33.995	26.501	155.67	0.424	0.01
250.0	7.347	34.012	26.596	147.29	0.500	-.06
300.0	6.905	34.024	26.667	141.09	0.572	-.11
350.0	6.594	34.084	26.756	133.19	0.641	-.11
400.0	6.221	34.110	26.826	127.04	0.706	-.14
450.0	5.792	34.132	26.898	120.51	0.768	-.17
500.0	5.601	34.197	26.972	113.90	0.826	-.15
600.0	5.227	34.289	27.091	103.50	0.935	-.12
700.0	4.890	34.342	27.172	96.52	1.035	-.12
800.0	4.441	34.378	27.251	89.39	1.128	-.14
850.0	4.343	34.401	27.281	86.96	1.172	-.13
900.0	4.225	34.415	27.305	84.96	1.215	-.13
950.0	4.097	34.431	27.331	82.70	1.257	-.13
1000.0	3.986	34.445	27.354	80.76	1.297	-.13
1100.0	3.724	34.466	27.398	76.91	1.376	-.14
1200.0	3.506	34.481	27.432	73.96	1.451	-.15
1300.0	3.224	34.500	27.474	69.93	1.523	-.17
1400.0	2.986	34.519	27.511	66.35	1.592	-.17
1600.0	2.629	34.549	27.568	61.07	1.719	-.18
1800.0	2.308	34.581	27.621	55.91	1.836	-.18
2000.0	2.072	34.607	27.662	52.03	1.944	-.18
2100.0	1.994	34.619	27.678	50.62	1.995	-.18
2200.0	1.939	34.630	27.692	49.52	2.045	-.18
2300.0	1.870	34.637	27.703	48.52	2.094	-.18
2400.0	1.820	34.644	27.713	47.74	2.142	-.17
2500.0	1.751	34.650	27.724	46.76	2.190	-.17
2600.0	1.712	34.653	27.730	46.37	2.236	-.18
2626.1	1.698	34.653	27.731	46.28	2.248	-.18

STATION: 14 DATE: 3/26/89 2011 GMT
LAT: 36° 20.1' N. LON: 122° 39.2' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.485	33.326	25.197	275.99	0.000	0.27
5.0	12.483	33.326	25.198	276.07	0.014	0.27
10.0	12.478	33.327	25.200	276.02	0.028	0.27
15.0	12.475	33.327	25.201	276.08	0.041	0.27
20.0	12.481	33.326	25.199	276.39	0.055	0.27
25.0	12.462	33.327	25.203	276.10	0.069	0.27
30.0	12.445	33.327	25.207	275.88	0.083	0.26
35.0	12.222	33.348	25.266	270.36	0.097	0.24
40.0	11.199	33.372	25.473	250.67	0.110	0.06
45.0	11.105	33.400	25.513	247.04	0.122	0.07
50.0	10.973	33.431	25.560	242.66	0.134	0.07
60.0	10.737	33.499	25.655	233.84	0.158	0.08
70.0	10.249	33.526	25.761	223.97	0.181	0.01
80.0	10.009	33.595	25.856	215.12	0.203	0.03
90.0	9.664	33.668	25.970	204.42	0.224	0.03
100.0	9.351	33.756	26.090	193.20	0.243	0.04
125.0	8.839	33.889	26.276	175.96	0.290	0.07
150.0	8.519	33.961	26.382	166.24	0.332	0.07
175.0	8.121	33.993	26.468	158.49	0.373	0.04
200.0	7.739	33.992	26.523	153.48	0.412	-.02
250.0	7.311	34.027	26.613	145.67	0.487	-.05
300.0	6.895	34.077	26.710	137.00	0.558	-.07
350.0	6.346	34.081	26.787	130.11	0.625	-.14
400.0	6.050	34.128	26.862	123.49	0.688	-.14
450.0	5.791	34.181	26.936	116.87	0.748	-.14
500.0	5.578	34.214	26.989	112.30	0.805	-.14
600.0	5.313	34.283	27.076	105.07	0.914	-.11
650.0	5.038	34.302	27.123	100.78	0.966	-.13
700.0	4.823	34.320	27.162	97.34	1.015	-.14
750.0	4.711	34.355	27.203	93.89	1.063	-.13
800.0	4.587	34.386	27.242	90.54	1.109	-.12
850.0	4.386	34.406	27.280	87.08	1.153	-.12
900.0	4.238	34.426	27.312	84.31	1.196	-.12
950.0	4.068	34.438	27.339	81.84	1.238	-.13
1000.0	3.952	34.453	27.364	79.76	1.278	-.13
1200.0	3.440	34.494	27.448	72.21	1.430	-.15
1400.0	3.010	34.527	27.516	66.04	1.568	-.16
1600.0	2.631	34.562	27.578	60.15	1.694	-.17
1800.0	2.292	34.591	27.631	54.98	1.809	-.18
2000.0	2.081	34.612	27.665	51.79	1.916	-.18
2200.0	1.915	34.636	27.698	48.79	2.016	-.17
2400.0	1.822	34.648	27.716	47.48	2.113	-.17
2600.0	1.741	34.656	27.730	46.55	2.207	-.17
2800.0	1.688	34.662	27.740	46.07	2.299	-.17
3000.0	1.610	34.667	27.751	45.26	2.391	-.17
3100.0	1.583	34.668	27.754	45.11	2.436	-.18
3139.1	1.580	34.667	27.754	45.25	2.454	-.18

STATION: 15 DATE: 3/27/89 2311 GMT

LAT: 36° 20.0′ N. LON: 122° 42.2′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.546	33.323	25.183	277.33	0.000	0.28
5.0	12.547	33.323	25.183	277.45	0.014	0.28
10.0	12.539	33.323	25.185	277.44	0.028	0.28
15.0	12.532	33.323	25.186	277.42	0.042	0.28
20.0	12.518	33.323	25.189	277.29	0.055	0.28
25.0	12.497	33.322	25.192	277.12	0.069	0.27
30.0	12.436	33.322	25.204	276.08	0.083	0.26
35.0	12.311	33.324	25.230	273.79	0.097	0.24
40.0	11.768	33.330	25.336	263.73	0.110	0.14
45.0	11.367	33.370	25.442	253.81	0.123	0.09
50.0	11.306	33.379	25.460	252.20	0.136	0.09
60.0	11.082	33.426	25.537	245.11	0.161	0.08
70.0	10.664	33.496	25.665	233.07	0.185	0.06
80.0	10.375	33.540	25.750	225.20	0.208	0.05
90.0	9.888	33.616	25.892	211.85	0.229	0.02
100.0	9.477	33.707	26.031	198.80	0.250	0.03
125.0	8.897	33.862	26.246	178.82	0.297	0.05
150.0	8.488	33.939	26.370	167.39	0.340	0.05
175.0	8.248	33.988	26.445	160.65	0.381	0.05
200.0	7.776	33.993	26.519	153.91	0.421	-.01
225.0	7.498	34.000	26.564	149.91	0.459	-.05
250.0	7.275	34.009	26.603	146.51	0.496	-.07
275.0	7.040	34.039	26.660	141.47	0.532	-.08
300.0	6.830	34.073	26.715	136.45	0.566	-.09
325.0	6.556	34.083	26.760	132.41	0.600	-.11
350.0	6.366	34.094	26.794	129.43	0.633	-.13
375.0	6.118	34.105	26.835	125.73	0.665	-.15
400.0	5.963	34.121	26.867	122.86	0.696	-.16
425.0	5.935	34.164	26.905	119.60	0.726	-.13
450.0	5.789	34.185	26.940	116.53	0.756	-.13
500.0	5.558	34.221	26.997	111.55	0.813	-.13
600.0	5.116	34.285	27.101	102.44	0.919	-.13
700.0	4.762	34.336	27.182	95.40	1.019	-.14
800.0	4.565	34.390	27.248	89.98	1.111	-.12
900.0	4.261	34.431	27.313	84.22	1.198	-.12
1000.0	3.975	34.455	27.363	79.90	1.280	-.13
1200.0	3.461	34.496	27.448	72.31	1.432	-.15
1400.0	2.966	34.537	27.528	64.79	1.568	-.16
1600.0	2.642	34.564	27.579	60.14	1.693	-.17
1800.0	2.375	34.583	27.617	56.57	1.810	-.18
2000.0	2.101	34.607	27.660	52.40	1.919	-.18
2200.0	1.932	34.627	27.690	49.66	2.020	-.18
2400.0	1.832	34.642	27.711	48.03	2.118	-.17
2600.0	1.752	34.653	27.727	46.91	2.213	-.17
2800.0	1.680	34.661	27.740	46.03	2.306	-.17
3000.0	1.631	34.666	27.749	45.63	2.398	-.17
3159.6	1.581	34.666	27.753	45.40	2.470	-.18

STATION: 16 DATE: 3/27/89 0923 GMT

LAT: 36° 19.6′ N. LON: 122° 48.9′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.617	33.337	25.180	277.61	0.000	0.31
5.0	12.617	33.337	25.180	277.73	0.014	0.31
10.0	12.620	33.337	25.180	277.90	0.028	0.31
15.0	12.624	33.337	25.180	278.08	0.042	0.31
20.0	12.626	33.337	25.179	278.25	0.056	0.31
25.0	12.467	33.346	25.217	274.77	0.069	0.28
30.0	11.843	33.376	25.358	261.43	0.083	0.19
35.0	11.540	33.429	25.456	252.22	0.096	0.17
40.0	11.289	33.440	25.511	247.14	0.108	0.13
45.0	11.093	33.459	25.561	242.49	0.120	0.11
50.0	10.933	33.466	25.595	239.35	0.132	0.09
60.0	10.516	33.529	25.717	227.94	0.156	0.06
70.0	10.183	33.580	25.814	218.86	0.178	0.05
80.0	9.749	33.666	25.954	205.73	0.199	0.04
90.0	9.496	33.718	26.037	198.08	0.220	0.04
100.0	9.424	33.782	26.099	192.37	0.239	0.08
125.0	8.816	33.894	26.283	175.23	0.285	0.07
150.0	8.487	33.989	26.410	163.65	0.328	0.09
175.0	7.902	33.987	26.495	155.75	0.368	0.00
200.0	7.668	34.035	26.568	149.28	0.406	0.00
225.0	7.501	34.069	26.619	144.76	0.443	0.01
250.0	7.519	34.115	26.653	142.03	0.478	0.04
275.0	7.345	34.117	26.679	139.83	0.514	0.02
300.0	6.968	34.122	26.735	134.67	0.548	-.03
325.0	6.674	34.127	26.779	130.72	0.581	-.06
350.0	6.464	34.138	26.816	127.42	0.613	-.08
375.0	6.297	34.153	26.850	124.43	0.645	-.09
400.0	6.176	34.188	26.893	120.64	0.675	-.08
425.0	6.085	34.201	26.915	118.81	0.705	-.08
450.0	5.894	34.204	26.942	116.44	0.735	-.10
500.0	5.611	34.235	27.002	111.17	0.791	-.12
600.0	5.156	34.299	27.107	101.89	0.897	-.12
700.0	4.921	34.373	27.194	94.59	0.996	-.09
800.0	4.565	34.406	27.260	88.81	1.087	-.10
900.0	4.280	34.436	27.315	84.10	1.174	-.11
1000.0	3.976	34.466	27.372	79.09	1.255	-.12
1200.0	3.494	34.506	27.453	71.97	1.406	-.14
1400.0	3.093	34.538	27.517	66.23	1.544	-.15
1600.0	2.683	34.562	27.574	60.77	1.671	-.17
1800.0	2.368	34.586	27.620	56.27	1.788	-.17
2000.0	2.082	34.612	27.665	51.80	1.896	-.18
2200.0	1.918	34.631	27.694	49.19	1.997	-.18
2400.0	1.823	34.646	27.715	47.64	2.094	-.17
2600.0	1.759	34.654	27.727	46.93	2.188	-.17
2800.0	1.680	34.663	27.741	45.89	2.281	-.17
3000.0	1.599	34.666	27.753	44.98	2.372	-.17
3062.1	1.591	34.667	27.753	45.18	2.400	-.18

STATION: 17 DATE: 3/27/89 1418 GMT

LAT: 36° 20.0′ N. LON: 122° 55.8′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.2	12.209	33.427	25.329	263.52	0.001	0.30
5.0	12.193	33.447	25.348	261.83	0.013	0.31
10.0	12.190	33.458	25.357	261.09	0.026	0.32
20.0	12.162	33.472	25.373	259.82	0.052	0.32
30.0	11.897	33.489	25.436	254.02	0.078	0.29
40.0	10.948	33.551	25.658	233.11	0.102	0.16
50.0	10.169	33.676	25.891	211.15	0.125	0.12
70.0	9.530	33.776	26.076	193.90	0.165	0.09
80.0	9.319	33.843	26.163	185.86	0.184	0.11
100.0	9.030	33.931	26.278	175.25	0.220	0.13
150.0	8.438	34.036	26.453	159.48	0.304	0.12
200.0	7.814	34.082	26.583	147.84	0.380	0.06
250.0	6.943	34.048	26.680	139.09	0.452	-.09
275.0	6.805	34.075	26.721	135.57	0.486	-.09
300.0	6.548	34.101	26.775	130.61	0.520	-.10
325.0	6.422	34.114	26.802	128.36	0.552	-.11
350.0	6.326	34.145	26.839	125.14	0.584	-.10
400.0	6.084	34.187	26.904	119.51	0.645	-.09
450.0	5.877	34.234	26.968	114.02	0.703	-.08
500.0	5.646	34.258	27.015	109.91	0.759	-.09
600.0	5.267	34.325	27.115	101.36	0.865	-.09
700.0	4.873	34.373	27.199	94.00	0.963	-.09
800.0	4.512	34.402	27.263	88.45	1.054	-.11
900.0	4.205	34.436	27.323	83.19	1.140	-.12
1000.0	3.894	34.463	27.378	78.33	1.221	-.13
1200.0	3.368	34.502	27.461	70.77	1.369	-.15
1400.0	2.898	34.535	27.532	64.14	1.504	-.17
1600.0	2.587	34.562	27.582	59.63	1.627	-.17
1700.0	2.414	34.574	27.606	57.21	1.686	-.18
1800.0	2.253	34.588	27.631	54.74	1.741	-.18
1900.0	2.152	34.596	27.646	53.40	1.796	-.18
2000.0	2.069	34.605	27.661	52.15	1.848	-.18
2100.0	1.981	34.614	27.675	50.81	1.900	-.18
2200.0	1.909	34.623	27.689	49.66	1.950	-.18
2300.0	1.857	34.630	27.699	48.86	1.999	-.18
2400.0	1.806	34.640	27.711	47.86	2.048	-.18
2500.0	1.767	34.646	27.719	47.27	2.095	-.18
2600.0	1.737	34.652	27.727	46.78	2.142	-.18
2700.0	1.708	34.655	27.732	46.51	2.189	-.18
2800.0	1.674	34.659	27.738	46.10	2.235	-.18
3000.0	1.622	34.664	27.748	45.64	2.327	-.18
3100.0	1.606	34.665	27.750	45.63	2.372	-.18
3200.0	1.584	34.668	27.755	45.42	2.418	-.18
3300.0	1.579	34.670	27.757	45.50	2.463	-.18
3400.0	1.567	34.672	27.760	45.48	2.509	-.18
3500.0	1.565	34.673	27.762	45.66	2.554	-.18
3557.5	1.559	34.673	27.763	45.72	2.581	-.18

STATION: 18 DATE: 3/28/89 0130 GMT

LAT: 36° 20.1′ N. LON: 123° 1.5′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.4	12.543	33.458	25.288	267.33	0.001	0.39
5.0	12.556	33.472	25.297	266.65	0.013	0.40
10.0	12.455	33.463	25.309	265.58	0.027	0.38
15.0	12.265	33.469	25.351	261.77	0.040	0.34
20.0	12.042	33.471	25.394	257.74	0.053	0.30
25.0	11.235	33.517	25.579	240.24	0.065	0.18
30.0	10.831	33.560	25.685	230.27	0.077	0.15
40.0	10.285	33.646	25.848	215.03	0.099	0.12
50.0	9.747	33.738	26.011	199.74	0.120	0.10
60.0	9.611	33.768	26.056	195.62	0.140	0.10
80.0	9.193	33.853	26.191	183.17	0.177	0.10
90.0	9.110	33.893	26.236	179.13	0.195	0.11
100.0	8.988	33.929	26.283	174.77	0.213	0.12
150.0	8.425	34.013	26.438	160.97	0.297	0.10
200.0	7.615	34.026	26.568	149.18	0.374	-.01
250.0	6.926	34.021	26.661	140.87	0.446	-.11
300.0	6.814	34.092	26.733	134.81	0.515	-.07
350.0	6.552	34.136	26.803	128.77	0.581	-.07
400.0	6.187	34.166	26.874	122.41	0.644	-.10
450.0	5.908	34.209	26.944	116.29	0.703	-.10
500.0	5.756	34.237	26.986	112.85	0.761	-.10
600.0	5.236	34.297	27.096	103.03	0.869	-.11
700.0	4.929	34.351	27.175	96.32	0.969	-.11
800.0	4.462	34.395	27.263	88.36	1.061	-.12
900.0	4.185	34.428	27.319	83.54	1.146	-.13
1000.0	3.887	34.457	27.373	78.69	1.228	-.13
1100.0	3.604	34.475	27.417	74.80	1.304	-.15
1200.0	3.360	34.499	27.460	70.90	1.377	-.15
1300.0	3.111	34.516	27.497	67.40	1.446	-.16
1400.0	2.935	34.528	27.523	65.09	1.512	-.17
1500.0	2.793	34.540	27.546	63.13	1.577	-.17
1600.0	2.579	34.556	27.578	59.98	1.638	-.18
1700.0	2.406	34.567	27.601	57.64	1.697	-.19
1800.0	2.261	34.583	27.627	55.21	1.753	-.19
1900.0	2.169	34.591	27.641	53.96	1.808	-.19
2000.0	2.039	34.599	27.658	52.21	1.861	-.19
2200.0	1.902	34.617	27.684	50.02	1.963	-.19
2300.0	1.864	34.626	27.695	49.26	2.013	-.18
2400.0	1.818	34.635	27.706	48.36	2.062	-.18
2500.0	1.774	34.643	27.717	47.57	2.110	-.18
2600.0	1.731	34.650	27.726	46.85	2.157	-.18
2700.0	1.696	34.655	27.733	46.35	2.203	-.18
2800.0	1.667	34.660	27.740	45.94	2.249	-.18
2900.0	1.642	34.665	27.746	45.54	2.295	-.17
3000.0	1.626	34.666	27.749	45.54	2.341	-.17
3100.0	1.610	34.668	27.752	45.49	2.386	-.17
3200.0	1.585	34.670	27.756	45.29	2.431	-.18

STATION: 20 DATE: 3/29/89 0723 GMT

LAT: 36° 5.6 'N. LON: 123° 30.9' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.248	32.980	24.974	297.21	0.000	-.05
5.0	12.248	32.981	24.975	297.25	0.015	-.05
10.0	12.153	33.005	25.012	293.85	0.030	-.05
15.0	11.786	33.056	25.120	283.68	0.044	-.08
20.0	11.432	33.108	25.225	273.79	0.058	-.10
25.0	10.720	33.214	25.435	253.91	0.071	-.15
30.0	10.562	33.286	25.519	246.06	0.084	-.12
35.0	10.007	33.197	25.544	243.77	0.096	-.29
40.0	9.872	33.234	25.595	238.98	0.108	-.28
45.0	9.990	33.409	25.712	227.96	0.120	-.12
50.0	9.887	33.442	25.756	223.97	0.131	-.12
60.0	9.597	33.545	25.884	211.93	0.153	-.08
70.0	9.381	33.607	25.968	204.11	0.173	-.07
80.0	9.294	33.663	26.026	198.83	0.193	-.04
90.0	9.346	33.759	26.093	192.69	0.213	0.05
100.0	9.201	33.774	26.128	189.53	0.232	0.03
150.0	8.723	34.020	26.397	164.92	0.319	0.15
200.0	8.078	34.073	26.538	152.28	0.398	0.09
250.0	7.380	34.073	26.639	143.20	0.472	-.01
300.0	6.802	34.107	26.746	133.53	0.541	-.06
350.0	6.539	34.135	26.804	128.65	0.606	-.08
400.0	6.301	34.186	26.876	122.37	0.669	-.07
450.0	5.901	34.185	26.926	117.97	0.729	-.12
500.0	5.656	34.222	26.986	112.72	0.787	-.12
600.0	5.212	34.270	27.077	104.76	0.896	-.14
700.0	4.735	34.341	27.189	94.70	0.995	-.13
800.0	4.473	34.400	27.265	88.13	1.087	-.12
900.0	4.120	34.430	27.327	82.61	1.172	-.13
1000.0	3.857	34.465	27.383	77.75	1.252	-.13
1100.0	3.531	34.488	27.434	73.00	1.327	-.15
1200.0	3.301	34.505	27.470	69.76	1.398	-.15
1400.0	2.920	34.535	27.530	64.39	1.532	-.17
1600.0	2.579	34.562	27.582	59.54	1.657	-.17
1800.0	2.284	34.584	27.626	55.41	1.771	-.18
1900.0	2.159	34.594	27.644	53.63	1.826	-.18
2000.0	2.063	34.603	27.659	52.23	1.879	-.19
2100.0	1.978	34.614	27.676	50.78	1.930	-.18
2200.0	1.910	34.625	27.690	49.53	1.980	-.18
2300.0	1.861	34.632	27.700	48.77	2.029	-.18
2400.0	1.807	34.639	27.710	47.94	2.078	-.18
2500.0	1.770	34.646	27.719	47.31	2.125	-.18
2600.0	1.737	34.651	27.726	46.85	2.172	-.18
2700.0	1.705	34.655	27.732	46.47	2.219	-.18
2800.0	1.680	34.660	27.739	46.09	2.265	-.17
2900.0	1.654	34.663	27.744	45.85	2.311	-.17
3000.0	1.631	34.666	27.749	45.62	2.357	-.17
3100.0	1.610	34.667	27.752	45.56	2.403	-.18

STATION: 22 DATE: 3/28/89 2353 GMT
LAT: 35° 46.1' N. LON: 124° 12.8' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	13.199	33.231	24.984	296.31	0.000	0.34
5.0	12.791	33.234	25.067	288.55	0.015	0.26
10.0	12.589	33.242	25.112	284.34	0.029	0.23
15.0	12.370	33.249	25.160	279.91	0.043	0.19
20.0	12.357	33.257	25.169	279.21	0.057	0.19
25.0	12.295	33.261	25.184	277.91	0.071	0.18
30.0	12.157	33.259	25.209	275.66	0.085	0.15
35.0	11.224	33.258	25.380	259.43	0.098	-.02
40.0	10.964	33.259	25.428	255.00	0.111	-.07
45.0	10.733	33.287	25.490	249.17	0.124	-.09
50.0	10.529	33.326	25.556	243.01	0.136	-.10
60.0	10.521	33.428	25.637	235.51	0.160	-.02
70.0	10.492	33.552	25.739	226.03	0.183	0.08
80.0	10.095	33.570	25.822	218.37	0.205	0.02
90.0	9.985	33.676	25.923	208.96	0.227	0.09
100.0	9.258	33.704	26.064	195.60	0.247	-.01
125.0	8.816	33.867	26.262	177.24	0.293	0.05
150.0	8.670	33.971	26.367	167.73	0.336	0.10
175.0	8.240	33.995	26.452	160.02	0.377	0.06
200.0	8.025	34.023	26.506	155.26	0.417	0.05
225.0	7.728	34.050	26.571	149.41	0.455	0.02
250.0	7.478	34.082	26.632	143.90	0.492	0.01
300.0	6.856	34.058	26.701	137.87	0.562	-.09
350.0	5.973	34.029	26.792	129.24	0.629	-.23
400.0	5.539	34.065	26.875	121.74	0.691	-.26
450.0	5.225	34.102	26.942	115.72	0.751	-.27
500.0	4.962	34.137	27.000	110.52	0.807	-.27
600.0	4.651	34.234	27.113	100.62	0.912	-.23
700.0	4.477	34.332	27.210	92.28	1.008	-.17
800.0	4.217	34.393	27.287	85.62	1.097	-.15
900.0	3.958	34.423	27.338	81.21	1.181	-.15
1000.0	3.688	34.457	27.393	76.35	1.259	-.15
1200.0	3.238	34.510	27.480	68.67	1.404	-.16
1400.0	2.921	34.536	27.531	64.34	1.537	-.16
1600.0	2.591	34.562	27.581	59.68	1.661	-.17
1800.0	2.298	34.584	27.624	55.58	1.777	-.18
2000.0	2.062	34.603	27.660	52.21	1.885	-.19
2200.0	1.912	34.624	27.689	49.63	1.986	-.18
2400.0	1.822	34.639	27.709	48.14	2.084	-.18
2600.0	1.750	34.648	27.723	47.23	2.179	-.18
2800.0	1.682	34.658	27.737	46.28	2.273	-.18
3000.0	1.636	34.663	27.746	45.91	2.365	-.18
3200.0	1.597	34.666	27.752	45.75	2.457	-.18
3400.0	1.565	34.668	27.758	45.72	2.548	-.18
3600.0	1.537	34.672	27.764	45.58	2.640	-.18
3800.0	1.516	34.675	27.769	45.60	2.731	-.18
3930.2	1.499	34.677	27.773	45.53	2.790	-.18

STATION: 23 DATE: 3/29/89 1553 GMT
LAT: 36° 27.2′ N. LON: 122° 47.1′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.642	33.315	25.158	279.69	0.000	0.30
5.0	12.644	33.316	25.159	279.77	0.014	0.30
10.0	12.644	33.315	25.158	279.96	0.028	0.30
15.0	12.645	33.315	25.158	280.11	0.042	0.30
20.0	12.640	33.313	25.158	280.28	0.056	0.29
25.0	12.577	33.313	25.170	279.23	0.070	0.28
30.0	12.402	33.314	25.205	276.06	0.084	0.25
35.0	11.987	33.320	25.288	268.24	0.097	0.17
40.0	11.464	33.347	25.406	257.06	0.111	0.09
45.0	11.261	33.378	25.467	251.39	0.123	0.08
50.0	11.085	33.413	25.527	245.85	0.136	0.07
60.0	10.717	33.494	25.655	233.85	0.160	0.07
70.0	10.140	33.573	25.816	218.66	0.182	0.03
80.0	9.753	33.659	25.948	206.31	0.203	0.03
90.0	9.424	33.710	26.042	197.57	0.224	0.02
100.0	9.109	33.798	26.162	186.31	0.243	0.04
150.0	8.351	33.957	26.405	164.05	0.329	0.04
200.0	7.680	33.995	26.534	152.42	0.408	-.03
250.0	7.148	34.027	26.635	143.45	0.481	-.08
300.0	6.830	34.084	26.725	135.59	0.551	-.08
350.0	6.507	34.122	26.798	129.18	0.617	-.09
400.0	6.137	34.160	26.876	122.24	0.680	-.11
450.0	5.792	34.182	26.937	116.79	0.740	-.13
475.0	5.663	34.202	26.969	114.01	0.769	-.14
500.0	5.484	34.204	26.992	111.91	0.797	-.16
600.0	5.065	34.272	27.096	102.76	0.905	-.15
700.0	4.764	34.341	27.186	95.05	1.003	-.13
800.0	4.515	34.392	27.255	89.21	1.096	-.12
900.0	4.234	34.422	27.309	84.55	1.182	-.13
1000.0	3.953	34.452	27.363	79.85	1.265	-.13
1100.0	3.610	34.478	27.418	74.66	1.342	-.15
1200.0	3.350	34.505	27.466	70.33	1.415	-.15
1300.0	3.141	34.524	27.501	67.18	1.483	-.15
1400.0	2.953	34.538	27.529	64.57	1.549	-.16
1600.0	2.633	34.565	27.580	59.96	1.674	-.17
1800.0	2.341	34.588	27.624	55.80	1.789	-.17
2000.0	2.074	34.608	27.663	51.99	1.897	-.18
2100.0	1.968	34.619	27.680	50.28	1.948	-.18
2200.0	1.887	34.631	27.697	48.81	1.997	-.18
2300.0	1.839	34.637	27.706	48.14	2.046	-.18
2400.0	1.799	34.644	27.715	47.47	2.094	-.18
2500.0	1.757	34.650	27.723	46.85	2.141	-.17
2600.0	1.729	34.654	27.729	46.53	2.188	-.17
2700.0	1.698	34.658	27.735	46.17	2.234	-.17
2800.0	1.677	34.663	27.741	45.86	2.280	-.17
2900.0	1.651	34.663	27.744	45.80	2.326	-.17
2948.4	1.619	34.666	27.749	45.30	2.348	-.17

STATION: 24 DATE: 3/29/89 1953 GMT
LAT: 36° 35.8′ N. LON: 122° 29.2′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.390	33.245	25.153	280.23	0.000	0.19
5.0	12.387	33.245	25.153	280.29	0.014	0.19
10.0	12.348	33.248	25.163	279.48	0.028	0.18
15.0	12.263	33.269	25.196	276.48	0.042	0.18
20.0	12.097	33.332	25.276	268.99	0.056	0.20
25.0	12.019	33.353	25.308	266.10	0.069	0.20
30.0	11.804	33.370	25.361	261.15	0.082	0.17
35.0	11.548	33.396	25.428	254.86	0.095	0.15
40.0	11.258	33.439	25.515	246.74	0.108	0.13
45.0	11.054	33.482	25.585	240.18	0.120	0.12
50.0	10.884	33.515	25.641	234.92	0.132	0.12
60.0	10.683	33.538	25.695	230.03	0.155	0.10
70.0	10.334	33.609	25.811	219.18	0.177	0.09
80.0	9.829	33.662	25.938	207.32	0.199	0.05
90.0	9.718	33.743	26.019	199.74	0.219	0.09
100.0	9.534	33.806	26.099	192.34	0.239	0.11
125.0	9.029	33.939	26.285	175.12	0.285	0.14
150.0	8.737	33.990	26.371	167.35	0.327	0.13
175.0	8.432	34.024	26.445	160.71	0.368	0.11
200.0	8.126	34.058	26.519	154.11	0.408	0.09
225.0	7.960	34.086	26.566	150.02	0.446	0.09
250.0	7.471	34.073	26.626	144.47	0.483	0.00
275.0	7.509	34.141	26.675	140.35	0.518	0.06
300.0	7.124	34.132	26.722	136.05	0.553	0.00
325.0	6.906	34.148	26.765	132.21	0.586	-.02
350.0	6.752	34.160	26.795	129.63	0.619	-.03
375.0	6.519	34.176	26.839	125.71	0.651	-.05
400.0	6.298	34.197	26.885	121.55	0.682	-.06
425.0	6.197	34.213	26.911	119.35	0.712	-.06
450.0	6.093	34.221	26.931	117.71	0.742	-.07
475.0	6.019	34.248	26.962	115.08	0.771	-.05
500.0	5.883	34.259	26.987	112.84	0.799	-.06
600.0	5.359	34.308	27.090	103.78	0.907	-.09
700.0	4.935	34.345	27.170	96.83	1.007	-.11
800.0	4.595	34.387	27.242	90.59	1.101	-.11
900.0	4.285	34.415	27.298	85.69	1.189	-.13
1000.0	3.981	34.442	27.352	80.94	1.272	-.14
1200.0	3.461	34.481	27.436	73.44	1.426	-.16
1400.0	3.050	34.519	27.506	67.12	1.567	-.17
1600.0	2.672	34.551	27.566	61.46	1.695	-.18
1800.0	2.340	34.577	27.615	56.59	1.813	-.18
2000.0	2.098	34.600	27.654	52.88	1.922	-.19
2200.0	1.969	34.616	27.678	50.92	2.026	-.18
2400.0	1.847	34.632	27.702	48.95	2.125	-.18
2600.0	1.761	34.647	27.721	47.46	2.221	-.18
2800.0	1.667	34.662	27.741	45.80	2.314	-.17
2960.1	1.628	34.666	27.749	45.46	2.387	-.17

STATION: 25 DATE: 3/29/89 2230 GMT

LAT: 36° 33.4′ N. LON: 122° 16.1′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.154	33.480	25.380	258.61	0.000	0.33
5.0	12.161	33.480	25.379	258.82	0.013	0.33
10.0	12.149	33.478	25.380	258.90	0.026	0.33
15.0	11.922	33.489	25.431	254.10	0.039	0.29
20.0	11.877	33.487	25.438	253.60	0.051	0.28
25.0	11.499	33.519	25.533	244.65	0.064	0.24
30.0	10.800	33.607	25.728	226.27	0.076	0.18
35.0	10.500	33.646	25.810	218.50	0.087	0.15
40.0	10.107	33.712	25.929	207.26	0.097	0.14
45.0	9.792	33.754	26.015	199.22	0.108	0.12
50.0	9.537	33.801	26.094	191.80	0.117	0.11
60.0	9.336	33.841	26.158	185.87	0.136	0.11
70.0	8.971	33.906	26.268	175.66	0.154	0.10
80.0	8.892	33.911	26.284	174.28	0.172	0.09
90.0	8.688	33.915	26.319	171.13	0.189	0.06
100.0	8.598	33.926	26.342	169.11	0.206	0.06
125.0	8.412	33.971	26.406	163.51	0.248	0.06
150.0	7.974	34.014	26.506	154.35	0.287	0.03
175.0	7.753	34.025	26.547	150.84	0.326	0.01
200.0	7.560	34.024	26.574	148.58	0.363	-.02
225.0	7.313	34.046	26.627	143.87	0.399	-.04
250.0	7.178	34.079	26.672	139.99	0.435	-.03
275.0	7.133	34.125	26.715	136.34	0.469	0.00
300.0	7.084	34.130	26.726	135.67	0.503	-.01
325.0	6.812	34.151	26.780	130.76	0.537	-.03
350.0	6.717	34.164	26.803	128.87	0.569	-.03
375.0	6.552	34.181	26.839	125.73	0.601	-.04
400.0	6.564	34.208	26.859	124.26	0.632	-.02
425.0	6.260	34.203	26.895	120.93	0.663	-.06
450.0	6.096	34.217	26.927	118.08	0.693	-.07
475.0	5.939	34.230	26.957	115.42	0.722	-.08
500.0	5.817	34.243	26.983	113.20	0.750	-.08
600.0	5.391	34.306	27.085	104.32	0.859	-.09
700.0	4.844	34.359	27.191	94.68	0.958	-.11
800.0	4.501	34.397	27.260	88.69	1.050	-.12
900.0	4.305	34.415	27.296	85.92	1.136	-.12
1000.0	4.050	34.442	27.345	81.75	1.220	-.13
1200.0	3.436	34.489	27.445	72.54	1.374	-.15
1400.0	3.025	34.530	27.517	66.00	1.512	-.16
1600.0	2.653	34.560	27.575	60.56	1.639	-.17
1800.0	2.351	34.584	27.620	56.21	1.755	-.18
2000.0	2.157	34.601	27.651	53.53	1.865	-.18
2100.0	2.053	34.610	27.667	52.01	1.918	-.18
2200.0	1.914	34.628	27.692	49.36	1.969	-.18
2300.0	1.859	34.634	27.702	48.60	2.017	-.18
2400.0	1.790	34.643	27.715	47.42	2.065	-.18
2500.0	1.776	34.648	27.720	47.24	2.113	-.17

STATION: 27 DATE: 3/30/89 0448 GMT

LAT: 36° 43.3' N. LON: 122° 14.3' W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	12.001	33.357	25.314	264.94	0.000	0.20
5.0	11.999	33.357	25.314	265.04	0.013	0.20
10.0	11.996	33.356	25.314	265.14	0.027	0.20
15.0	11.982	33.357	25.317	264.93	0.040	0.20
20.0	11.962	33.358	25.322	264.64	0.053	0.20
25.0	11.858	33.361	25.344	262.67	0.066	0.18
30.0	11.332	33.419	25.486	249.30	0.079	0.12
35.0	10.558	33.525	25.706	228.39	0.091	0.07
40.0	10.357	33.576	25.780	221.45	0.102	0.07
45.0	10.142	33.645	25.871	212.94	0.113	0.09
50.0	9.944	33.684	25.935	206.94	0.124	0.09
60.0	9.413	33.752	26.076	193.66	0.143	0.05
70.0	9.169	33.843	26.187	183.36	0.162	0.08
80.0	9.052	33.888	26.241	178.42	0.180	0.10
90.0	8.994	33.919	26.275	175.40	0.198	0.12
100.0	8.935	33.962	26.318	171.52	0.215	0.14
125.0	8.826	34.013	26.375	166.51	0.258	0.16
150.0	8.487	34.065	26.469	158.05	0.298	0.15
175.0	8.238	34.077	26.516	153.92	0.337	0.12
200.0	8.101	34.108	26.561	150.05	0.375	0.13
225.0	7.941	34.120	26.595	147.26	0.412	0.11
250.0	7.813	34.131	26.623	144.98	0.449	0.10
275.0	7.489	34.120	26.661	141.63	0.485	0.04
300.0	7.115	34.126	26.718	136.37	0.519	0.00
325.0	6.937	34.134	26.750	133.69	0.553	-.02
350.0	6.730	34.147	26.788	130.30	0.586	-.04
375.0	6.562	34.152	26.814	128.06	0.618	-.06
400.0	6.415	34.160	26.841	125.81	0.650	-.07
425.0	6.361	34.172	26.857	124.59	0.681	-.07
450.0	6.198	34.199	26.899	120.79	0.712	-.07
475.0	5.953	34.211	26.940	117.03	0.742	-.09
500.0	5.835	34.225	26.966	114.78	0.771	-.10
550.0	5.692	34.243	26.998	112.22	0.828	-.10
600.0	5.480	34.281	27.055	107.24	0.883	-.10
650.0	5.289	34.309	27.100	103.38	0.935	-.10
700.0	5.108	34.326	27.135	100.39	0.986	-.10
750.0	4.924	34.343	27.170	97.36	1.035	-.11
800.0	4.628	34.375	27.229	91.89	1.083	-.12
850.0	4.515	34.387	27.251	90.09	1.128	-.12
900.0	4.381	34.401	27.277	87.89	1.173	-.13
950.0	4.200	34.422	27.313	84.60	1.216	-.13
1000.0	4.009	34.443	27.350	81.18	1.257	-.13
1033.7	3.867	34.459	27.377	78.58	1.284	-.13

STATION: 28 DATE: 3/30/89 0636 GMT

LAT: 36° 45.2′ N. LON: 122° 2.6′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.0	12.089	33.425	25.350	261.50	0.000	0.27
5.0	12.093	33.424	25.348	261.76	0.013	0.27
10.0	12.054	33.427	25.358	260.93	0.026	0.27
15.0	11.947	33.432	25.382	258.80	0.039	0.25
20.0	11.474	33.453	25.486	249.02	0.052	0.18
25.0	10.621	33.538	25.705	228.28	0.064	0.09
30.0	10.258	33.585	25.804	218.95	0.075	0.06
35.0	10.096	33.616	25.856	214.11	0.086	0.06
40.0	9.731	33.703	25.985	201.94	0.096	0.07
45.0	9.600	33.743	26.038	196.98	0.106	0.08
50.0	9.501	33.775	26.080	193.17	0.116	0.08
60.0	9.284	33.807	26.140	187.62	0.135	0.07
70.0	9.128	33.856	26.203	181.79	0.154	0.09
80.0	8.985	33.871	26.238	178.66	0.172	0.08
90.0	8.977	33.890	26.254	177.31	0.189	0.09
100.0	8.867	33.943	26.313	171.91	0.207	0.11
125.0	8.776	33.982	26.359	168.05	0.249	0.13
150.0	8.638	34.013	26.405	164.17	0.291	0.13
175.0	8.411	34.038	26.459	159.37	0.331	0.12
200.0	8.145	34.069	26.524	153.58	0.371	0.10
225.0	7.931	34.087	26.570	149.59	0.409	0.08
250.0	7.682	34.097	26.615	145.64	0.445	0.05
275.0	7.451	34.098	26.649	142.76	0.481	0.02
300.0	7.182	34.114	26.700	138.18	0.517	0.00
325.0	6.975	34.130	26.742	134.49	0.551	-.02
350.0	6.793	34.143	26.776	131.48	0.584	-.04
375.0	6.664	34.156	26.804	129.10	0.617	-.04
400.0	6.574	34.166	26.824	127.50	0.649	-.05
425.0	6.430	34.174	26.850	125.34	0.680	-.06
450.0	6.187	34.182	26.888	121.87	0.711	-.09
475.0	6.106	34.192	26.906	120.43	0.741	-.09
500.0	5.970	34.213	26.940	117.40	0.771	-.09
550.0	5.599	34.258	27.022	109.90	0.828	-.10
600.0	5.339	34.291	27.080	104.75	0.882	-.10
650.0	5.165	34.311	27.116	101.68	0.933	-.11
700.0	4.925	34.336	27.164	97.37	0.983	-.12
750.0	4.798	34.351	27.190	95.23	1.031	-.12
800.0	4.718	34.363	27.209	93.87	1.078	-.12
850.0	4.605	34.372	27.229	92.30	1.125	-.13
900.0	4.350	34.399	27.279	87.66	1.170	-.13
950.0	4.215	34.413	27.304	85.46	1.213	-.14
1000.0	4.197	34.423	27.315	84.93	1.256	-.13
1005.7	4.200	34.423	27.314	85.02	1.261	-.13

STATION: 29 DATE: 3/30/89 0811 GMT

LAT: 36° 42.0′ N. LON: 122° 2.0′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta$D	π
0.0	11.903	33.449	25.403	256.40	0.000	0.26
5.0	11.903	33.449	25.403	256.51	0.013	0.26
10.0	11.896	33.450	25.406	256.43	0.026	0.26
15.0	11.858	33.453	25.415	255.65	0.038	0.25
20.0	11.237	33.479	25.550	242.95	0.051	0.16
25.0	10.643	33.530	25.695	229.28	0.063	0.09
30.0	10.400	33.563	25.763	222.87	0.074	0.07
35.0	10.170	33.597	25.829	216.72	0.085	0.06
40.0	9.947	33.652	25.909	209.16	0.096	0.06
45.0	9.676	33.745	26.027	198.06	0.106	0.09
50.0	9.476	33.794	26.099	191.36	0.116	0.10
60.0	9.381	33.800	26.119	189.60	0.135	0.09
70.0	9.194	33.873	26.207	181.49	0.153	0.11
80.0	9.102	33.894	26.238	178.72	0.171	0.11
90.0	9.073	33.923	26.265	176.35	0.189	0.13
100.0	8.997	33.942	26.292	173.92	0.206	0.13
125.0	8.903	33.956	26.319	171.90	0.250	0.13
150.0	8.664	34.018	26.404	164.19	0.292	0.14
175.0	8.464	34.041	26.454	159.95	0.332	0.13
200.0	8.334	34.064	26.492	156.70	0.372	0.13
225.0	8.025	34.082	26.553	151.29	0.410	0.09
250.0	7.701	34.093	26.609	146.22	0.447	0.05
275.0	7.460	34.102	26.651	142.55	0.483	0.03
300.0	7.261	34.101	26.679	140.24	0.519	0.00
325.0	7.146	34.106	26.699	138.62	0.554	-.02
350.0	6.921	34.131	26.750	134.08	0.588	-.03
375.0	6.826	34.139	26.769	132.56	0.621	-.03
400.0	6.614	34.160	26.814	128.46	0.654	-.05
425.0	6.515	34.177	26.841	126.24	0.686	-.05
450.0	6.264	34.199	26.891	121.62	0.717	-.06
475.0	6.093	34.208	26.920	119.04	0.747	-.08
500.0	6.025	34.218	26.937	117.72	0.776	-.08
550.0	5.756	34.245	26.992	112.87	0.834	-.09
600.0	5.427	34.283	27.063	106.48	0.889	-.10
650.0	5.229	34.308	27.106	102.71	0.941	-.10
700.0	4.985	34.335	27.156	98.20	0.992	-.11
750.0	4.775	34.358	27.199	94.43	1.040	-.12
800.0	4.618	34.377	27.231	91.60	1.086	-.12
850.0	4.444	34.395	27.265	88.64	1.131	-.12
900.0	4.266	34.408	27.295	85.99	1.175	-.13
950.0	4.104	34.428	27.328	82.99	1.217	-.13
1000.0	4.015	34.437	27.345	81.69	1.259	-.14
1100.0	3.731	34.462	27.394	77.28	1.338	-.15
1200.0	3.573	34.484	27.427	74.55	1.413	-.15
1300.0	3.290	34.507	27.473	70.18	1.485	-.15
1400.0	3.062	34.525	27.509	66.81	1.554	-.16
1500.0	2.763	34.552	27.558	61.89	1.618	-.17

STATION: 26 DATE: 3/30/89 0923 GMT

LAT: 36 36.6' N. LON: 122 9.9' W.

P(dbar)	T(C)	S(psu)	γ_θ(kg m)	δ	$\Sigma\Delta D$	π
0.0	11.714	33.450	25.439	252.97	0.000	0.22
5.0	11.713	33.451	25.440	252.99	0.013	0.22
10.0	11.719	33.450	25.439	253.30	0.025	0.22
15.0	11.719	33.450	25.439	253.41	0.038	0.22
20.0	11.713	33.462	25.449	252.50	0.051	0.23
25.0	11.697	33.471	25.460	251.65	0.063	0.23
30.0	11.656	33.478	25.473	250.53	0.076	0.23
35.0	11.567	33.490	25.498	248.21	0.088	0.22
40.0	11.097	33.578	25.652	233.72	0.100	0.21
45.0	10.230	33.662	25.869	213.09	0.111	0.12
50.0	9.875	33.711	25.968	203.82	0.122	0.10
60.0	9.569	33.781	26.073	193.97	0.142	0.10
70.0	9.274	33.843	26.170	184.96	0.161	0.10
80.0	9.036	33.868	26.228	179.64	0.179	0.08
90.0	8.895	33.887	26.265	176.29	0.197	0.07
100.0	8.654	33.898	26.311	172.04	0.214	0.05
125.0	8.389	33.959	26.400	164.04	0.256	0.05
150.0	8.129	33.993	26.466	158.15	0.297	0.04
175.0	7.800	34.014	26.532	152.30	0.335	0.01
200.0	7.523	34.032	26.586	147.48	0.373	-.02
225.0	7.701	34.123	26.632	143.60	0.409	0.08
250.0	7.527	34.135	26.667	140.63	0.445	0.06
300.0	7.223	34.143	26.717	136.59	0.514	0.02
350.0	6.760	34.136	26.775	131.54	0.581	-.05
400.0	6.436	34.191	26.862	123.82	0.645	-.05
450.0	6.123	34.216	26.923	118.52	0.705	-.07
500.0	5.900	34.225	26.958	115.60	0.764	-.09
600.0	5.428	34.294	27.071	105.65	0.875	-.09
650.0	5.080	34.331	27.142	99.13	0.926	-.10
700.0	4.864	34.328	27.164	97.23	0.975	-.13
750.0	4.731	34.349	27.196	94.58	1.024	-.13
800.0	4.578	34.378	27.237	91.05	1.070	-.12
850.0	4.459	34.392	27.261	89.05	1.115	-.13
900.0	4.361	34.409	27.285	87.06	1.159	-.12
950.0	4.199	34.425	27.316	84.37	1.202	-.13
1000.0	4.051	34.440	27.343	81.90	1.243	-.13
1100.0	3.704	34.468	27.401	76.51	1.323	-.14
1200.0	3.464	34.486	27.440	73.09	1.398	-.15
1300.0	3.269	34.512	27.479	69.56	1.469	-.15
1400.0	3.086	34.527	27.509	66.95	1.537	-.16
1500.0	2.905	34.541	27.537	64.39	1.603	-.16
1600.0	2.767	34.553	27.559	62.44	1.666	-.17
1700.0	2.600	34.567	27.585	59.96	1.727	-.17
1800.0	2.417	34.582	27.614	57.10	1.786	-.17
1900.0	2.286	34.595	27.635	55.10	1.842	-.17
2000.0	2.132	34.608	27.658	52.71	1.896	-.18
2100.0	2.053	34.616	27.671	51.56	1.948	-.18

STATION: 30 DATE: 3/30/89 1511 GMT
LAT: 36° 47.1′ N. LON: 121° 56.0′ W.

P(dbar)	T(°C)	S(psu)	γ_θ(kg m^{-3})	δ	$\Sigma\Delta D$	π
0.4	12.210	33.462	25.355	260.96	0.001	0.33
5.0	12.153	33.454	25.360	260.63	0.013	0.31
10.0	11.819	33.462	25.430	254.15	0.026	0.25
15.0	11.111	33.500	25.588	239.16	0.038	0.15
20.0	10.546	33.559	25.734	225.41	0.050	0.09
25.0	10.312	33.618	25.821	217.28	0.061	0.10
30.0	10.073	33.690	25.918	208.13	0.072	0.11
35.0	9.926	33.723	25.968	203.46	0.082	0.12
40.0	9.779	33.740	26.006	199.96	0.092	0.10
45.0	9.620	33.770	26.056	195.32	0.102	0.10
50.0	9.366	33.831	26.145	186.92	0.111	0.11
60.0	9.181	33.874	26.209	181.08	0.130	0.11
70.0	8.969	33.909	26.271	175.39	0.148	0.10
80.0	8.830	33.963	26.335	169.45	0.165	0.12
90.0	8.779	33.981	26.357	167.55	0.182	0.13
100.0	8.707	33.983	26.370	166.52	0.198	0.12
125.0	8.542	33.994	26.405	163.66	0.240	0.10
150.0	8.289	34.015	26.460	158.85	0.280	0.08
175.0	8.143	34.027	26.492	156.21	0.319	0.07
200.0	7.882	34.057	26.554	150.68	0.358	0.05
225.0	7.682	34.072	26.595	147.12	0.395	0.03
250.0	7.500	34.082	26.629	144.21	0.431	0.02
275.0	7.354	34.093	26.659	141.74	0.467	0.00
300.0	7.061	34.121	26.722	135.99	0.502	-.02
325.0	6.838	34.144	26.771	131.63	0.535	-.03
350.0	6.671	34.160	26.806	128.54	0.568	-.04
375.0	6.600	34.170	26.823	127.25	0.600	-.04
400.0	6.461	34.182	26.852	124.81	0.631	-.05
425.0	6.203	34.207	26.905	119.90	0.662	-.06
450.0	5.972	34.231	26.954	115.44	0.691	-.07
475.0	5.920	34.237	26.965	114.67	0.720	-.08
500.0	5.888	34.241	26.973	114.25	0.749	-.08
549.3	5.737	34.255	27.003	111.88	0.804	-.08

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